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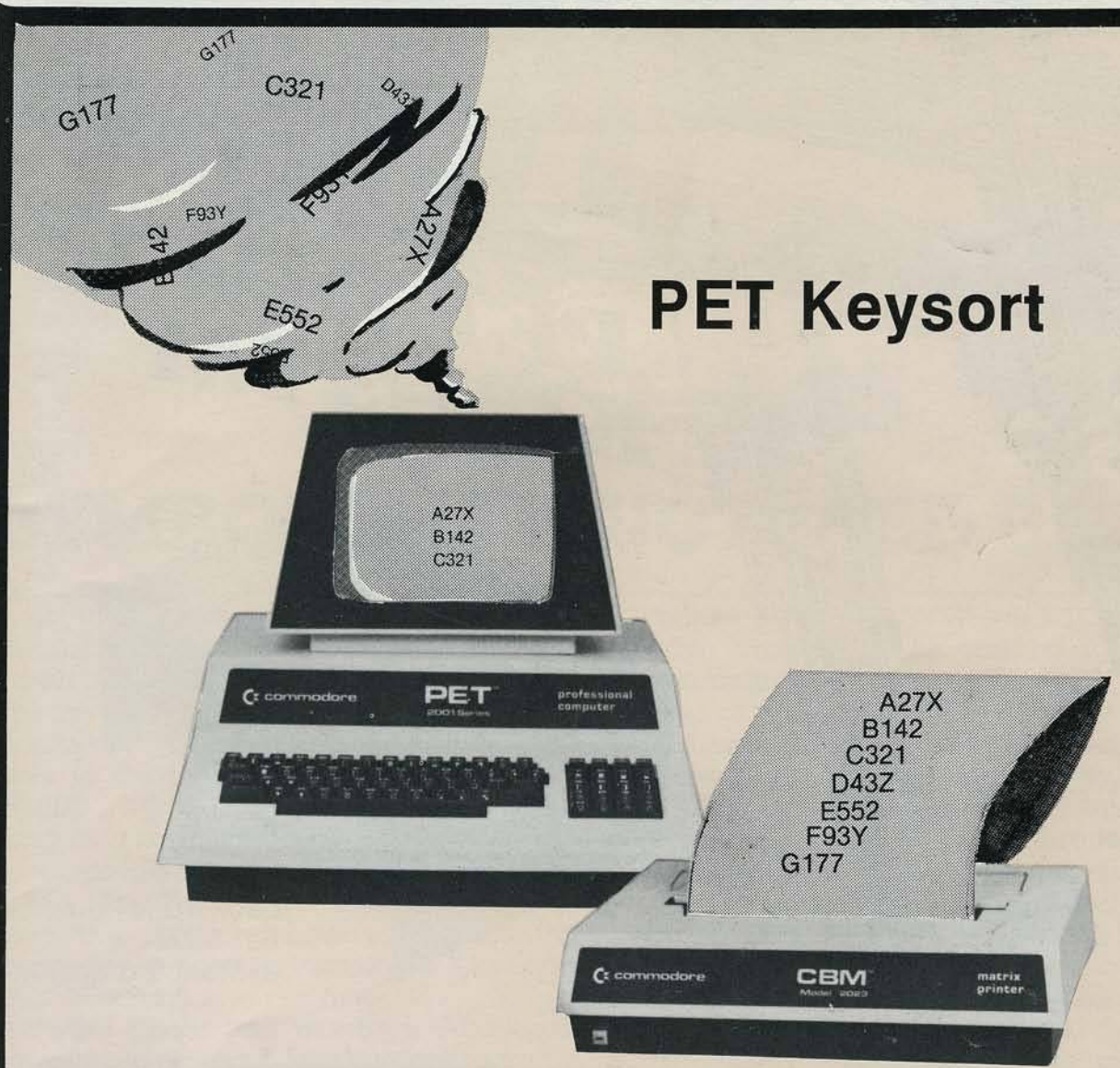
THE 6502 JOURNAL



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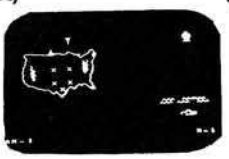

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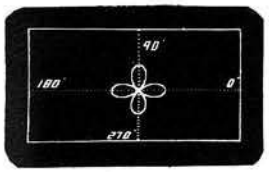

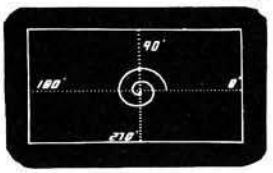

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Applesoft II Shorthand

If you want to make Applesoft a little easier to use, try this program which permits entire commands to be input with a single control key. Since the command lookup is table driven, you can select the keys to conform to your own preferences. The techniques used provide a valuable understanding of how to add your own modifications.

Allen J. Lacy
1921 W. Oglethorpe
Albany, GA 31707

This routine allows a programmer to type in an entire Applesoft command with the use of one control key.

Overview

The routine Shorthand ties into the input hooks at $38 and $39 (56 and 57 decimal) and uses a table inside the RAM version of Applesoft II. In Applesoft's table, each command is represented as an ASCII string with the high bit off except for the last character of the string which has the high bit set. The routine also uses a monitor routine to read a key. If it is a control character, shorthand gets an address from its internal table. If the high byte of the address is 0, the routine passes the control character back. If the address is not 0 shorthand passes the command stored at that location back.

Step 1 turns DOS off. Step 2 turns Shorthand on. Step 3 turns DOS back on. But DOS will not be on at the same time as shorthand.

To use with ROM version.

Shorthand could be adapted to run with the ROM version of Applesoft II. The addresses in Shorthand would have to be changed. I do not have access to a ROM card and so do not know the addresses. But if the ROM version is just a relocated RAM version, the addresses in Shorthand and table just need $C800 added to them.

Shorthand does not use all of the control keys because some have special functions. These functions are shown in Table 1. If you do not mind losing these functions, these keys can be used also. The choices for which command is tied to which key is shown in the program listing. If you do not like my choices, you can change the command addresses stored in Table 2. The addresses are for the RAM version and will not work for the ROM version.

Use Of Shorthand

Shorthand is relocatable and can be placed anywhere in memory. I normally load it at $300—$3AE, which is where I assembled it. But it can be placed anywhere. Applesoft's HIMEM: can be used to protect some upper memory.

Example:
A 32K system without DOS can have Shorthand loaded at $7F51-7FFF and then HIMEM: can be set to 32593.
So to bring up Shorthand use the following steps:

1. LOAD and RUN the Applesoft TAPE
2. Enter the monitor by pressing RESET or do a CALL—151
3. Type
   300.3AER
   or type
   7F51.7FFFR
4. Start tape with Shorthand on it and press RETURN, stop the tape when it has loaded
5. Type
   OG
   Press Return
6. Type
   POKE 1144,0
   Press RETURN
7. If Shorthand is at $300—$3AE type
   POKE 56,0; POKE 57,3
   If Shorthand is at $7F51—$7FFF type
   POKE 56,81: POKE 57,127
8. Press RETURN
9. If Shorthand is at 7F51 type
   HIMIM: 32593
   Press RETURN

Another good place to store Shorthand is between Applesoft II and your program. The problem is that Applesoft's LOMEM: does not set the lowest memory used by Applesoft, but sets the point at which Applesoft will start storing variables. But the monitor can be used to set pointers. To do this the following steps are used:

1. LOAD and RUN the Applesoft II tape
2. Enter the monitor by pressing RESET or do a CALL—151
3. Type
   3000.30AER
4. Start the tape with Shorthand on it and press RETURN
   When it has loaded stop the tape.
5. Type
   67:B0 30
   Press RETURN
6. Type 30AF:0
   30AF:0
   Press RETURN
7. Type
   0G

```
                        1000 ***********************************
                        1010 *                                 *
                        1020 *     APPLESOFT II SHORTHAND      *
                        1030 *                                 *
                        1040 *       BY ALLEN J LACY           *
                        1050 *         SEPT 1979               *
                        1060 *                                 *
                        1070 ***********************************
                        1080 *
                        1090 ZP   .EQ $1E       R15 OF SWEET16
                        1100 *
                        1110 ***********************************
                        1120 *                                 *
                        1130 * LOCATIONS 478-47F NOT USED BY  *
                        1140 *  SCREEN DISPLAY SEE MICRO # 8   *
                        1150 *                                 *
                        1160 ***********************************
                        1170 *
                        1180 SW   .EQ $0478     SWITCH
                        1190 CT   .EQ $0479     CHAR COUNT
                        1200 XSAV .EQ $047A
                        1210 YSAV .EQ $047B
                        1220 POIN .EQ $047C     POINTER
                        1230 ZPS  .EQ $047E
                        1240 *
                        1250 RKEY .EQ $FD1B     KEY READ CODE
                        1260 SW16 .EQ $F689     SWEET16
                        1270      .OR $300
                        1280 *
                        1290 ***********************************
                        1300 *                                 *
                        1310 * START LOCATION OF SHORTHAND    *
                        1320 *                                 *
                        1330 ***********************************
                        1340 *
300- 8E 7A 04           1350 SH   STX XSAV      SAVE X REG
303- 8C 7B 04           1360      STY YSAV      SAVE Y REG
306- 48                 1370      PHA           SAVE ACC
307- A5 1E              1380      LDA ZP        SAVE ZERO PAGE
309- 8D 7E 04           1390      STA ZPS        LOCATIONS
30C- A5 1F              1400      LDA ZP+1
30E- 8D 7F 04           1410      STA ZPS+1
                        1420 *
                        1430 ***********************************
                        1440 *                                 *
                        1450 * SWEET16 IS USED TO STORE KP    *
                        1460 * PROGRAM COUNTER IN $1E $1F     *
                        1470 * AND THIS IS USED TO FIND       *
                        1480 * THE LOCATION OF THE TABLE IN   *
                        1490 * SHORTHAND                      *
                        1500 *                                 *
                        1510 ***********************************
                        1520 *
311- 20 89 F6           1530      JSR SW16      ENTER SWEET16
314- 00                 1540      .HS 00        LEAVE SWEET16
                        1550 KP   .EQ *         KNOWN POINT
315- AD 78 04           1560      LDA SW
318- D0 3B              1570      BNE NBYT      CHECK SW
31A- 68                 1580      PLA           RESTORE ACC
31B- 20 1B FD           1590      JSR RKEY      READ A KEY
31E- 48                 1600      PHA           STORE KEY VAL
31F- C9 9B              1610      CMP #$9B      CONTROL KEY?
321- 90 14              1620      BCC CTR
                        1630 *
                        1640 ***********************************
                        1650 *                                 *
                        1660 * IF NOT A CONTROL JUST RETURN   *
                        1670 *                                 *
                        1680 ***********************************
                        1690 *
323- 68                 1700 RET  PLA           RESTORE KEY
324- AE 7A 04           1710 RT   LDX XSAV      RESTORE X REG
327- AC 7B 04           1720      LDY YSAV      RESTORE Y REG
32A- 48                 1730      PHA
32B- AD 7E 04           1740      LDA ZPS       RESTORE ZERO
32E- 85 1E              1750      STA ZP         PAGE LOCATIONS
330- AD 7F 04           1760      LDA ZPS+1
333- 85 1F              1770      STA ZP+1
335- 68                 1780      PLA
336- 60                 1790      RTS
337- 29 7F              1800 CTR  AND #$7F      WHICH KEY
339- 0A                 1810      ASL           TIMES 2
33A- 69 64              1820      ADC #TAB-KP   OFFSET FROM KP
33C- A8                 1830      TAY
33D- C8                 1840      INY
33E- B1 1E              1850      LDA (ZP),Y    LOAD ENTRY
                        1860 *
                        1870 ***********************************
                        1880 *                                 *
                        1890 * IF VALUE OF THE HIGH BYTE IN   *
                        1900 *  TABLE IS 0 THEN RETURN THE     *
                        1910 *  CONTROL CHAR ELSE SET UP TO    *
                        1920 *  RETURN THE CHARACTERS FROM     *
                        1930 *  APPLESOFT'S INTERNAL TABLE     *
                        1940 *                                 *
                        1950 ***********************************
                        1960 *
340- F0 E1              1970      BEQ RET       IF 0 RETURN
342- 8D 7D 04           1980      STA POIN+1    STORE IN POIN
345- 88                 1990      DEY
346- B1 1E              2000      LDA (ZP),Y
348- 8D 7C 04           2010      STA POIN
34B- A9 FF              2020      LDA #$FF      SET SW
```

```
34D- 8D 78 04  2030       STA SW
350- A9 00     2040       LDA #0        SET CT TO 0
352- 8D 79 04  2050       STA CT
               2060 *
               2070 *********************************
               2080 *                               *
               2090 * NBYT IS USED TO PASS THE      *
               2100 *  CHARACTERS FROM THE TABLE IN *
               2110 *  APPLESOFT AS IF THEY WERE    *
               2120 *  TYPED IN                     *
               2130 *                               *
               2140 *********************************
               2150 *
355- 68        2160 NBYT PLA
356- AC 79 04  2170       LDY CT        LOAD CHAR CT
359- AD 7C 04  2180       LDA POIN      STORE POIN IN
35C- 85 1E     2190       STA ZP         ZERO PAGE
35E- AD 7D 04  2200       LDA POIN+1
361- 85 1F     2210       STA ZP+1
363- B1 1E     2220       LDA (ZP),Y    LOAD NEXT CHAR
365- C9 80     2230       CMP #$80      LAST CHAR?
367- B0 07     2240       BCS END
369- 09 80     2250       ORA #$80
36B- EE 79 04  2260       INC CT        INCREMENT CT
36E- D0 B4     2270       BNE RT        RETURN CHAR
370- 48        2280 END   PHA           SAVE CHAR
371- A9 00     2290       LDA #0        RESET SW
373- 8D 78 04  2300       STA SW
376- 68        2310       PLA           RESTORE CHAR
377- D0 AB     2320       BNE RT        RETURN CHAR
               2330 *
               2340 *********************************
               2350 *                               *
               2360 *  TABLE TO STORE ADDRESSES OF  *
               2370 *   COMMANDS IN APPLESOFT II    *
               2380 *                               *
               2390 *  WILL HAVE TO BE CHANGED FOR  *
               2400 *   ROM VERSION                 *
               2410 *                               *
               2420 *********************************
379- 00 00     2430 TAB   .DA $000      @
37B- F9 08     2440       .DA $8F9      A CALL
37D- 3B 0A     2450       .DA $A3B      B PEEK
37F- 00 00     2460       .DA $000      C
381- 00 00     2470       .DA $000      D
383- EF 08     2480       .DA $8EF      E TEXT
385- D3 08     2490       .DA $8D3      F FOR
387- 00 00     2500       .DA $000      G
389- 00 00     2510       .DA $000      H
38B- DE 08     2520       .DA $8DE      I INPUT
38D- 00 00     2530       .DA $000      J
38F- D0 09     2540       .DA $9D0      K CONT
391- D4 09     2550       .DA $9D4      L LIST
393- 00 00     2560       .DA $000      M
395- D6 08     2570       .DA $8D6      N NEXT
397- EF 09     2580       .DA $9EF      O THEN
399- FD 08     2590       .DA $8FD      P PLOT
39B- 01 09     2600       .DA $901      Q HLIN
39D- 5B 09     2610       .DA $95B      R COLOR=
39F- A4 09     2620       .DA $9A4      S GOSUB
3A1- 93 09     2630       .DA $993      T GOTO
3A3- 00 00     2640       .DA $000      U
3A5- 64 09     2650       .DA $964      V VTAB
3A7- 05 09     2660       .DA $905      W VLIN
3A9- 00 00     2770       .DA $000      X
3AB- 25 09     2680       .DA $925      Y HTAB
3AD- C7 09     2690       .DA $9C7      Z POKE
               2700 LS    .EN
```

Symbol Table

ZP	001E	SW	0478	CT	0479
XSAVE	047A	YSAV	047B	POIN	047C
ZPS	047E	RKEY	FD1B	SW16	F689
SH	0300	KP	0315	RET	0323
RT	0324	CTR	0337	NBYT	0355
END	0370	TAB	0379	LS	03AF

Table 1

Control U	->
Control H	<-
Control M	RETURN
Control J	Line feed
Control G	BELL
Control X	Kill input line
Control C	Stops a running program
Control D	Is used by DOS

Press RETURN

8. Type
   NEW
   Press RETURN
9. Type
   POKE 1144,0
   Press RETURN

10. Type
    POKE 56,0:POKE 57,48
    Press Return

Shorthand will now be tied in.

Step 5 sets the pointer which tells Applesoft II where to start storing a program to $30B0. Step 6 sets the byte just below the start point to 0, I do not know why Applesoft wants this, but it will bomb if it is not done. Step 8 causes Applesoft to reset the rest of its pointers to reflect the new start point.

Now every time you want to type one of the commands stored in the table just press the control key and another key at the same time.

Example:
To enter INPUT press the control key at the same time as the I.

I have made labels for my keyboard showing which command is under which key. To return full control to the key board, use the command IN 0. To turn Shorthand back on just POKE the correct values back into 56 and 57. Shorthand does not have to be turned off when you are finished programing and want to run a program, unless the program wants for input one of the control keys which Shorthand uses. I normally set the hooks when I bring up Applesoft and leave them set.

The routine should work with DOS. I do not have DOS so these techniques are not tested. Since DOS communicates with the rest of the system via the input and output hooks at $36—39, you can not set the hooks to tie in shorthand without turning off DOS. But DOS has its own internal hooks. Unfortunately the hooks are at different places for different memory sizes. In a 48K system the input hook is at $A998, $A999 (22120, 22119 decimal). For smaller systems subtract 48K—X from the numbers, where x is the memory size. The above information came from Exploring the APPLE II DOS by Andy Hertzfeld in MICRO 9. So POKE the address of Shorthand in the DOS hooks

Another way that should work is to turn DOS off by the use of the following steps.

1. After bringing up Applesoft and loading Shorthand type
   PR O:IN O
   Press RETURN

2. Use POKEs to set 56 and 57 if Shorthand is at $300
   POKE 56,0:POKE57,3

3. When you are finished type
   CALL 976
   Press RETURN

Step 1 turns DOS off. Step 2 turns shorthand back on. DOS will not be on at the same time as Shorthand.

Table 2

8D0 END	8D3 FOR	8D6 NEXT	8DA DATA
8DE INPUT	8E3 DEL	8E6 DIM	8E9 READ
8ED GR	8EF TEXT	901 HLIN	905 VLIN
909 HGR2	90D HGR	910 HCOLOR=	917 HPLOT
91C DRAW	920 XDRAW	925 HTAB	929 HOME
92D ROT=	931 SCALE=	937 SHLOAD	93D TRACE
942 NOTRACE	949 NORMAL	94F INVERSE	956 FLASH
95B COLOR=	961 POP	964 VTAB	968 HIMEM:
96E LOMEM:	974 ONERR	979 RESUME	97F RECALL
985 STORE	98A SPEED=	990 LET	993 GOTO
997 RUN	99A IF	99C RESTORE	9A3 &
9A4 GOSUB	9A9 RETURN	9AF REM	9B2 STOP
9B6 IN	9B8 WAIT	9BC LOAD	9D0 CONT
9D4 LIST	9D8 CLEAR	9DD GET	9E0 NEW
9E3 TAB(	9E7 TO	9E9 FN	9EB SPC(
9EF THEN	9F3 AT	9F5 NOT	9F8 STEP
9FC +	9FD -	9FE *	9FF /
A00 ↑	A01 AND	A04 OR	A06 >
A07 =	A08 <	A09 SGN	A0C INT
A0F ABS	A12 USR	A15 FRE	A18 SCRN(
A1D PDL	A20 POS	A23 SQR	A26 RND
A29 LOG	A2C EXP	A2F COS	A32 SIN
A35 TAN	A38 ATN	A3B PEEK	A3F LEN
A42 STR$	A46 VAL	A49 ASC	A4C CHR$
A50 LEFT$	A55 RIGHT$	A5B MID$	

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The Value of 16 Bits

Several years ago, the guest speaker at the local computer club, a gentleman from Texas Instruments, talked about the importance of the size of a microprocessor. Using all kinds of charts, tables, and various rather logical sounding arguments, he determined that 8 bit micros did not make any sense and would never find much popularity or application! A 4 bit micro is all that is required in most process control situations, and anyone wanting to do real computer type stuff -number crunching, assembling, text processing - would much prefer a 16 bit micro. Conclusion: the 8 bit micro was doomed. Well, hundreds of thousands of 8 bit microcomputers later, it is obvious that there is a market for the 8 bit micro. Isn't 20/20 hindsight wonderful!

Actually, I did not buy this thesis at the time it was presented. I had worked on a number of projects with either minis or a precursor of the micros, and had discovered a number of instances in which an 8 bit processor was superior to its bigger brother. Does this seem strange. Let's examine the details.

One obvious type of application, in which we all participate to some degree, is any form of word processing. How many bits does it normally take to represent the normal alphanumerics and special symbols that we use in everyday writing, BASIC, assembler programming, and so forth? ASCII defines 128 characters, including a bunch of specialized control codes, and that seems to be enough for most applications. Even if you want to add special sets, such as greek for APL, the total number of unique codes required is normally going to be less than 256 decimal. Can you imagine a keyboard to generate more than 256 characters? Since 8 bits can be used to represent 256 unique values, it is adequate for this work. In fact, it is ideal. A 16 bit machine either must ignore half of each byte, which is of course wasteful and essentially reduces it to an 8 bit machine, or must pack two 8 bit bytes into each 16 bit word. And then it must, of course, unpack the two bytes for processing, repack them again, and so forth. Therefore, the 8 bit micro is perfect for most word processing based applications. Since this single application category must account for a large percentage of the systems being purchased today, the strength of the 8 bit micro should not be surprizing.

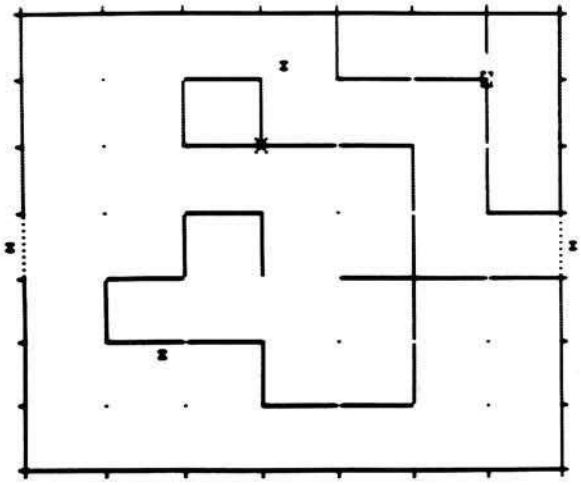
Another application I worked on used a high speed photo scanner to digitize material for use in newspaper production - halftones and text. The scanner produced 8 bit chunks of data. The minicomputer was 16 bit based, and a lot of overhead was spent in packing and unpacking data, making records come out to an integral number of words, and other such nonsense. While the fact that 8 bits were appropriate to this particular application may have been pure serendipity, I am sure that there are numerous process control types of application which have a similar data range and which could best be served by the 8 bit micro.

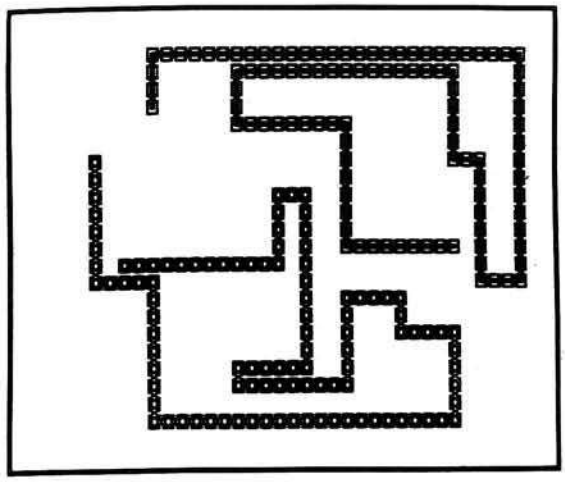
Okay, how about number processing. Surely the 16 bit micro is better at performing math functions than the 8 bit micro. True, there is some advantage to a 16 bit micro if your application requires a lot of number crunching. 16 bit math operations can handle twice as much data as 8 bit ones. But, the savings may be minimal. In many numeric calculations, the amount of code and time spent actually performing math functions may be insignificant relative to the amounts required to do all of the other programming steps required -the set up, testing one bit, branching, subroutine jumps, and so forth. So, while there will probably be a time improvement with a 16 bit micro in heavy math programs, the savings may not be as great as initially imagined.

Where does the 16 bit computer excel then? I am not sure that, in general, it does. Given the generally higher cost of the micro, the higher cost and complexity of a 16 bit data bus, and so forth, the 16 bit must justify itself for a particular application. It is not a generally "better" solution. There are some features of a typical 16 bit micro that would be nice to have in the 8 bit as well. This is particularly true in improved addressing capabilities. Since the address space of most 8 bit micros is actually 16 bits, it would make sense in many instances to be able to handle the full range of address space with 16 bit registers. In the 6502, a number of 16 bit addressing modes are already supported. The two main places where the 8 bit limit is restrictive are in the relative branches and in the indexed instructions. The "proposed" 6516 discussed by Randall Hyde in this issue shows how the benefits of a 16 bit micro can be combined with the strengths of the 8 bit micro to form a superior computer. It is interesting to note, however, that many of the improvements are **not** based on 16 bits, but are independent enhancements. My latest intelligence suggests that the initial statement in the referenced article -"Synertek is almost ready to ship the SY6516" - is a bit optimistic. But, if we all call and ask our Synertek Reps about this superior product, maybe we can get some action!

Robert M. Tripp

Software for the Apple II





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The APPLE Stripper

One of the classic dilemmas in BASIC has to do with REMarks. If you use them, they take up space and time. If you do not use them, the code is hard to understand. This program resolves the problem. It permits you to generously REMark your program for documentation purposes and then remove the REMarks for the run-time version.

Bill Crouch
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Long Beach, CA 90801

As a writer of custom business software for the APPLE computer,I kept running into the same conflict; good programming style insisted that I document my programs with frequent REMark statements. My customers would have a hard time understanding or changing my programs if I did not.

On the other hand, large business programs use a great deal of memory and every byte is precious. The Applesoft manual tells us that the statement: 130 THIS IS A COMMENT uses up 24 bytes of memory. In a large program, a lot of memory will be taken by REMs, leaving less for arrays and program operation. It also means more frequent waits while the machine "housecleans" its string space.

The answer is obvious; write the program with REMarks and then remove them in the final working version. If changes are needed, make them on the version with REMarks and then remove the REMs again after the bugs have been corrected.

Removing REMs by hand took too long so I wrote a simple program to do it for me. It is disk based and will work on any APPLE with a disk drive.

Program Requirements

To use this program you need only observe a couple of simple rules. First, NEVER GOTO or GOSUB to a REmark. Always GOTO or GOSUB to the first line of code after the REMark.

Secondly, for maximum benefits, put your REMarks on a separate line rather than at the end of a line of code. This program only eliminates those lines where a REM is the first thing in the line.

```
10  REM

        REM KILLER


20  REM BY BILL CROUCH
30  REM PO BOX 926
40  REM LONG BEACH CA 90801


50  PRINT  CHR$ (4);"MON I,O,C"
60  DIM ARRAY(1000)
70  ONERR  GOTO 240
80 X = 0
90  REM

        READ TEXT FILE


100  HOME : REM CLEAR SCREEN
110  PRINT  CHR$ (4);"OPEN PROG.FILE"
120  PRINT  CHR$ (4);"READ PROG.FILE"
130  INPUT L$: REM GET A LINE FROM DISK
140  IF  LEFT$ (L$,5) = "63000" GOTO 250: REM CHECK FOR END OF TEXT
150  IF L$ = "" GOTO 130: REM ELIMINATE NULL STRINGS
160 LN =  VAL (L$):LN =  INT (LN): REM SAVE LINE NUMBER
170  IF  LEFT$ (L$,1) = "" THEN L$ =  RIGHT$ (L$,( LEN (L$) - 1)): GOTO 1
     70
180  IF  LEN (L$) < 2 GOTO 130: REM IF LINE USED UP GET ANOTHER
190  IF  ASC (L$) < 65 THEN L$ =  RIGHT$ (L$,( LEN (L$) - 1)): GOTO 170
200  IF  LEFT$ (L$,3) = "REM" THEN X = X + 1:ARRAY(X) = LN: REM KEEP TRAC
     K OF REMS
210  IF X > 995 GOTO 250: REM STAY WITHIN ARRAY
220  GOTO 130: REM DO IT ALL AGAIN
230  REM

         WRITE STRIP FILE


240  IF  PEEK (222) <  > 5 GOTO 130: REM CHECK FOR OUT OF DATA ERROR
250  PRINT  CHR$ (4);"CLOSE"
260  POKE 216,0: REM CLEAR ONERR GOTO FLAG
270  IF X = 0 GOTO 340: REM NO REMS IN PROGRAM
280  PRINT  CHR$ (4);"OPEN STRIP.FILE"
290  PRINT  CHR$ (4);"WRITE STRIP.FILE"
300  FOR Y = 1 TO X
310  PRINT ARRAY(Y): REM SAVE LINE # OF REM
320  NEXT Y
330  PRINT  CHR$ (4);"CLOSE"
340  END

]

]PR#0
```

How to Use the Programs

There are two separate programs. The first, XFILE.MAKER, must be appended to the end of your program. You could type it in yourself or, better still, use the merge routine on the DOS 3.2 Master. The only requirement is that line 63000 be after the last line of your program. It tells the next program that it is done.

You start the process with the command "RUN 63000"

You should have both programs on their own diskette with plenty of space for their text files. If REM KILLER is not on the same diskette with XFILE.MAKER, remove line #63130.

XFILE.MAKER will convert your program into a text fie and then run REM KILLER. REM KILLER then reads the text file, makes a list of REMs and then writes them off as STRIP.FILE.

By the way, certain characters in your program will cause the computer to say EXTRA IGNORED during the running of REM KILLER. You can ignore it too.

When it is done, load your original program and EXEC STRIP.FILE. Every line which is a REMark will be removed. Then save the stripped program.

Of course also save a copy of your original program. The first program I used this on was part of a trucking company package. It saved me over 2400 bytes.

How it Works

XFILE.MAKER clears the screen with line 63050 and squashes the listing to suppress extra carriage returns with line 63060.

The rest of the program writes your program to the disk as a text file. Line 63130 calls REM killer.
(Note: CHR$(4) is the same as CTRL D and is required before every APPLE disk command.)

REM KILLER: Line 60 sets up an array in which REMs are saved. It now allows for 1000 REMs which probanly is too many. If you have memory limitations, you may reduce this number and the corresponding one on line 210.

Line 140 checks for the end of your file and is the reason line 63000 is required in XFILE.MAKER.

Lines 150-190 get rid of null lines and all non-alpha characters. Line 200 then sees if the first alpha string is REM. If so, it saves the number in the array.

Lines 240-340 save the approximate line numbers as a text file called STRIP.FILE.

When you EXEC STRIP.FILE, the line numbers are prnted just as if you had typed them yourself. And the REMark lines are eliminated.

XFILE.MAKER

```
63010  REM
           BY BILL CROUCH

63020  REM PO BOX 926
63030  REM LONG BEACH CA 90801


63040  REM APPEND TO END OF PROGRAM
63050  CALL  - 936
63060  POKE 33,33: REM FORMAT LISTING
63070  PRINT  CHR$ (4);"MON I,O,C": REM LET US SEE IT WORK
63080  PRINT  CHR$ (4);"OPEN PROG.FILE"
63090  PRINT  CHR$ (4);"WRITE PROG.FILE"
63100  LIST 0,63000
63110  PRINT  CHR$ (4);"CLOSE"
63120  TEXT
63130  PRINT  CHR$ (4);"RUN REM KILLER"
63140  END
63150  REM

           CHANGE CHR$(4) TO CRTL D FOR INTEGER PROGRAMS
```

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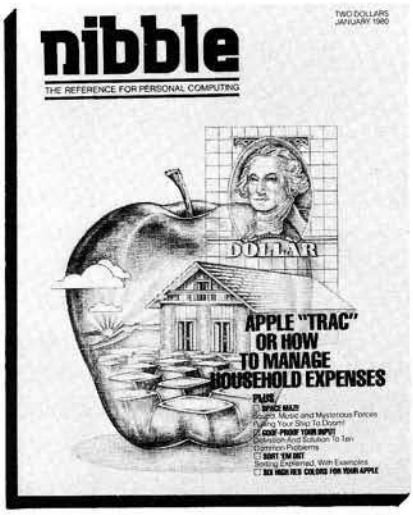

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Graphics and the Challenger C1P, Part 4

This continuing series on Graphics and the Challenger shows how to apply the material to create pictures and demonstrates how this may be used in Computer Aided Instruction.

William L. Taylor
246 Flora Road
Leavittsburg, OH 44430

Computers are well suited for use in an educational environment, whether this is in a class room at a local high school, college, or in an industrial training seminar. The computer can aid the instructor or can be used as an individual instructor. With the introduction of the micro processor and the number of low cost personal computers that are owned and used by individuals as a hobby, the computer must be considered as a training tool for use in the home environment.

Children seem fascinated by computers and are equally fascinated by any device that has a keyboard. If the computer has any form of graphics display, either animated or still, they seem even more delighted to experiment with the device. This leads to the point that if children are drawn to the computer, then the computer, if programmed to be a teaching aid, can be a valuable tool in their education.

With this evidence I decided to try to develope a program that combines the elements that have the most attraction for children. Also, through this method, the program will at the same time be an educational tool.

The program, which I will call "Picture" was developed to be a teaching aid in the developement and spelling of English words. The program uses Graphics to draw a picture of several objects. Then the child is asked to spell the different parts of the picture that have been displayed. The child tries to spell the names of the objects displayed, and the computer displays the answer "Right" or "Wrong" on the screen in large letters.

In Part 3 of this series ("Graphics and the Challenger C1P"), we described the features of the C1P. We developed some programs using Basic and Machine Language, in combination, to further explore the Graphics capabilities of the C1P. Many techniques were discussed and many Basic functions and statements were used in our example programs. This time let's continue with our graphics developmenmt and try a new programming approach.

This article has a two-fold purpose. First to continue our discussion of how to use the Graphics of the OSI Challenger C1P, and to secondly present a working program using the Graphics techniques in a Computer Assisted Instruction program (CAI). The program in this part will be used as a CAI tool and will be treated as an example program. *This program, by no means, is complete.* That is, it can be expanded by the user. The program simply is a pure example of how to develop graphic plots: get these characters out to the monitor screen. Combining these Graphics with a program is a useful tool in the hands of the enterprising programmer. From the techniques that are presented in this example, the user will more fully understand how to develop such programs of his own.

Program Description

Let's start with a description of the "picture" program. First, what the program does is to generate a picture on the monitor screen. This picture is shown in the video memory map plotting chart in Figure 1. Notice that we have developed routines in the program that will POKE characters from the Graphics Set in the Character Generator ROM out to the monitor screen at the locations shown on the chart. In part 3 of this series, I gave a similar video memory chart. This time we will use the chart as in Figure 1. Notice that in the chart, we have drawn the picture that we wish to POKE out to the screen. All the memory locations can now easily be found, and routines written to accomplish the end task. Such a routine is located in the program between lines 10000 and 10420. This routine is used to draw the House, the Airplane, the Sun, the Man and the Car in the picture. All the parts of the picture were built from the Graphics elements in the Character Generator ROM. A list of these character elements appears in the upper left corner of Figure 1.

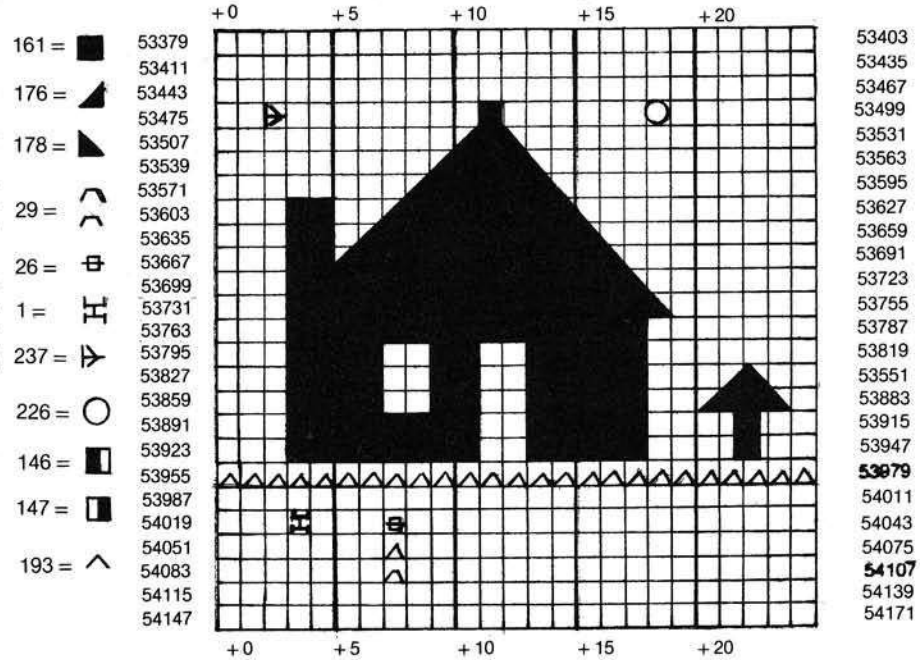
Please examine the program listing, starting at line 10000. Take the value in the statement line, For A = 53606 To 53926 Step 32. From these statement values find the corresponding value on the video memory map chart in Figure 1. It will be found that when the statement line at 10000 is compared to the memory map, you will be able to see just what the For-Next loop does. The Characters will be poke'd to these locations. Examine the program completely from line 10000 to 10420 to see how each unit works compared to the map. This example should give you a clear understanding of how to use the memory chart so that you can develop routines for your own program.

The program "Picture" contains two other Graphics Routines. These routines are used with the program to inform the user (or student) if he has identified and correctly spelled and element on the picture, or if he has identified and incorrectly spelled the object. These routines display the words: Right and Wrong, respectively. These words are in large graphic format at the top of the C1P's monitor screen. A video memory location map of these elements are in Figures 2 and 3. Please review these two figures for the memory locations. The subroutines for these graphic displays are located beginning at line 20000 for the word "Right" and at line 5000 for the word "Wrong".

These two subroutines were developed in the same manner as the one for the picture. That is, the video memory locations were plotted on the video memory plotting chart. Next, the graphics elements that were needed to generate the characters were selected from the list of graphics elements and finally, routines were written to do the task of POKEing the elements out to the screen. Analyze

```
OK
LIST

  1 GOSUB 8000
 35 PRINT"**** PICTURE ****":PRINT
 50 PRINT
 60 PRINT" HELLO IM A COMPUTER   MY NANE IS
  CHALLENGER"
70 PRINT:PRINT
80 PRINT" WHAT IS YOUR NAME?"
90 INPUT A$
100 PRINT:PRINT"HELLO "A$;"  GLAD TO MEET YOU"
110 PRINT:PRINT" THIS IS A SPELLING GAME";A$
120 PRINT:PRINT" I WILL SHOW YOU A"
130 PRINT" PICTURE.  YOU ARE TO"
140 PRINT"TELL ME THE PARTS"
150 PRINT" THAT YOU KNOW"
155 FOR Q=1 TO 10000:NEXT Q
160 POKE 11,232:POKE 12,15
170 X=USR(X)
180 GOSUB 10000
190 PRINT:PRINT" DID YOU SEE THE PICTURE?"
200 PRINT" TELL ME THE PARTS":PRINT
210 PRINT:PRINT" SPELL THE PARTS THAT MAKE
  THE PICTURE"
220 INPUT B$
230 IF B$="ROOF" THEN A=2
240 IF B$="CHIMNEY" THEN A=2
250 IF B$="WINDOW" THEN A=2
260 IF B$="DOOR" THEN A=2
270 IF B$="YARD" THEN A=2
280 IF B$="ROOF" THEN A=2
290 IF B$="CHIMNEY" THEN A=2
```



C1P Video Memory Map in Decimal

```
300 IF B$="SUN" THEN A=2
310 IF B$="PLANE" THEN A=2
330 IF A<>2  THEN GOSUB 5000
335 IF A=2 THEN GOSUB 20000
500 GOTO 200
5000 FOR A=53541 TO 53637 STEP 32
5010 POKE A,161:NEXT A
5020 FOR A=53544 TO 53640 STEP 32
5030 POKE A,161:NEXT A
5040 POKE 53638,175:POKE53639,
     177:POKE 53606,176:POKE 53607,178
5050 FOR A=53546TO53642STEP32
5060 POKEA,161:NEXTA
5070 POKE 53547,151:POKE 53548,161:
     POKE 53579,150
5080 POKE 53580,175:POKE 53611,177:
     POKE 53612,178
5090 POKE 53644,161
5100 FOR A=53550 TO 53646 STEP 32
5110 POKE A,161:NEXT A
5120 FOR A=53552 TO 53648 STEP 32
5130 POKE A,161:NEXT A
5140 POKE 53551,161:POKE 53647,161
5150 FORA=53554 TO 53650 STEP32
5160 POKE A,161:NEXT A
5170 FOR A=53556 TO 53652 STEP 32
5180 POKE A,161:NEXT A
5190 POKE 53587,178:POKE 53619,177
5200 FOR A=53590 TO 53654 STEP 32
5210 POKE A,161:NEXT A
5220 FOR A=53592 TO 53720 STEP 32
5230 POKEA,161:NEXT A
5240 FOR A=53591 TO 53719 STEP 64
5250 POKE A,161:NEXT A
5260 FOR T=1 TO 500:NEXT T
5270 X=USR(X)
5280 RETURN
8000 FOR Q=4072 TO 4095
8010 READ F:POKE Q,F
8020 NEXT Q
8030 DATA 169,32,160,8,162,0,157,0
8040 DATA 208,232,208,250,238,240
8050 DATA 15,136,208,244,169,208
8060 DATA 141,240,15,96
8070 RETURN
10000 FOR A=53606 TO 53926 STEP 32
10010 POKE A,161:NEXT A
10020 FOR A=53607 TO 53927 STEP 32
10030 POKE A,161:NEXT A
10040 FOR A=53517 TO 53672 STEP 31
10050 POKE A,176:NEXT A
10060 FOR A=53519 TO 53716 STEP 33
10070 POKE A,178:NEXT A
10080 FOR A=53673 TO 53683
10090 POKE A,161:NEXT A
10100 FOR A=53642 TO 53650
10110 POKE A,161:NEXT A
10120 FOR A=53611 TO 53617
10130 POKE A,161:NEXT A
10140 FOR A=53580 TO 53584
10150 POKE A,161:NEXT A
10160 FOR A=53549 TO 53551
10170 POKE A,161:NEXT A
10180 POKE 53518,161
10190 POKE 53486,171
10191 FOR A=53704 TO 53716
10192 POKE A,161:NEXT A
10193 FOR A=53736 TO 53748
10194 POKE A,161:NEXT A
10195 FOR A=53768 TO 53780
10196 POKE A,161:NEXT A
10200 FOR A=53804 TO 53805
10205 POKEA,161:NEXT A
10207 FOR A=53836 TO 53837
10240 POKE A,161:NEXT A
10250 FOR A=53896 TO 53901
10260 POKE A,161:NEXT A
10270 FOR A=53928 TO 53933
10280 POKE A,161:NEXT A
10290 FOR A=53937 TO 53940
10300 POKE A,161:NEXT A
10310 FOR A=53905 TO 53908
10320 POKE A,161:NEXT A
10330 FOR A=53873 TO 53876
10340 POKE A,161:NEXT A
10350 FOR A=53841 TO 53844
10360 POKE A,161:NEXT A
10370 FOR A=53809 TO 53812
10380 POKE A,161:NEXT A
10390 FOR A=53800 TO 53801
10400 POKE A,161:NEXT A
10402 POKE53477,237
10405 POKE 53493,226
10410 FOR A=53955 TO 53979
10420 POKE A,193:NEXT A
10430 FOR D=1 TO 5000:NEXT D
10440 X=USR(X)
10450 RETURN
20000 FOR A=53509 TO 53637
      STEP 32
20010 POKE A,161:NEXT A
20020 FOR A=53511 TO 53575
      STEP 32
20030 POKE A,161:NEXT A
20040 POKE 53607,178:POKE53639,
177:POKE 53574,161:POKE 53510,161
```

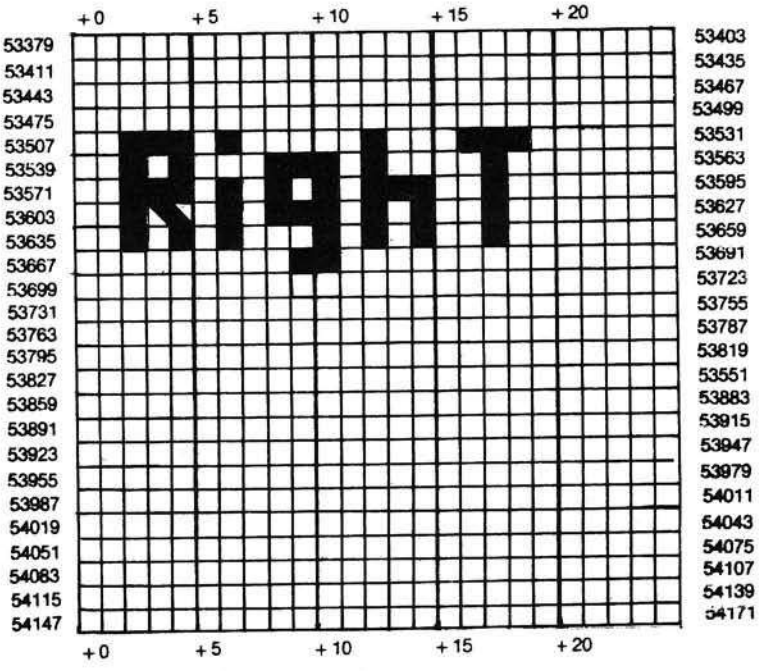
the video memory plotting charts of Figure 2 and Figure 3 along with the subroutines at lines 5000 and 20000 to see how the routines were plotted, written and used in the program.

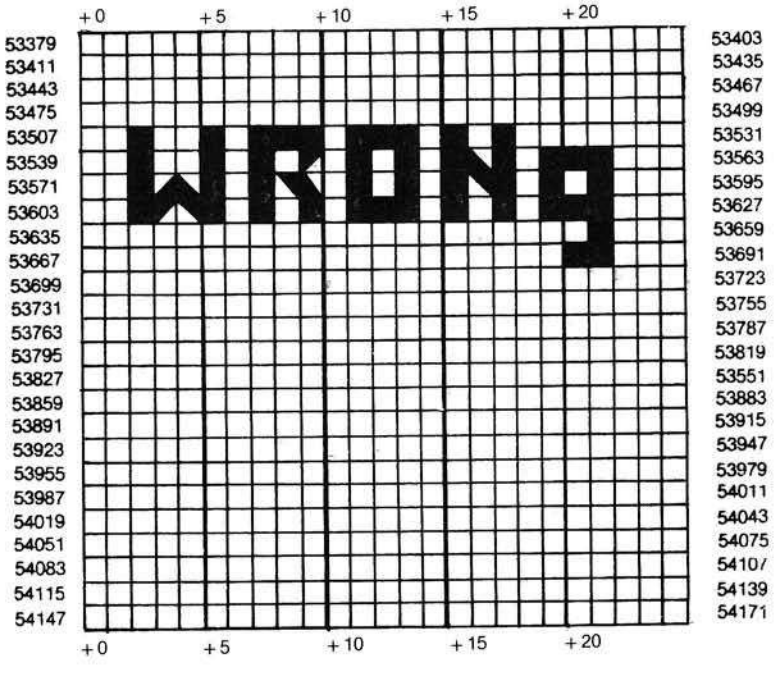
The subroutine located between lines 8000 and 8070 is for loading the machine code routine into user memory. This routine is for the Fast Screen Erase routine used by the program to clear the screen whenever called. This subroutine will be called at line 1 in the Main Line Basic program. The routine for the fast screen erase has been included in the previous parts of this series. The reader should review these parts for a complete description fo this routine.

Now that I have described the Graphics generating routines and how they were developed, let's continue with the Mainline BASIC program that uses the subroutines. The program from line 35 through 500 forms the BASIC CAI user program. This program is a demonstration of hc to develope programs in which thc use can be taught such things as spellin i which is the purpose of this program, ombined with the graphics pres tation.

The For-Next loop at line 155 is used to give the user time to read the screen text just displayed. Statement line 160 sets the USR Vector to point to the Fast Screen Erase Machine Language routine located at OFE8 hex or 8168 decimal. Line 170 causes the program to jump to the machine language routine at OFE8 ot 8168 decimal where the screen will be erased.

Input from the user is accepted at state ment line 220. This data is stored in a string variable, labeled B$. The input string (B$) is then compared in the string looking up table for a string match. If a match between the input and a table content is found, the information is then passed to the variable A as a decimal value. This value is then compared at Line 330 and Line 335 to check for a correct answer from the user. If a correct match was found in the string table, the A variable will force a GOSUB to Line 20000 where the answer word "Right" will be displayed for the user's answer. If a match did not occur in the string table, at line 330 a GOSUB to line 5000 will cause the answer word "WRONG" to be displayed informing the user that the answer was not correct or was not an element in the picture. At line 500 a return to the beginning of the BASIC Main-Line program will cause a new pass through the program.





This program, as stated before, is not really complete, but an example to show how such a program can be constructed. This program can be expanded or modified by the reader. If you should desire to expand the picture display to include more ojects, then these object names should be included in the string table.

The complete program including the Graphics routines and the fast screen erase routine is located at the top of the first 4K of user memory. If you have more memory and wish to expand the program, you will have to relocate this routine. Listing 2, shows the modifications to the program which will allow the routine to be relocated to begin at 1FE8 Hex or 8168 decimal. The user must set memory size to 4050 decimal for a system with 4K of memory, and 8167 for a 8 K system.

```
160 POKE 11,232 : POKE 12, 31

8000 FOR Q = 8168 TO 8191

8050 DATA 31,136,208,244,169,208

8060 DATA 141,240,31,96
```

```
 20045 POKE 53575,175:POKE 53606,162:
       POKE 53574,154
 20050 FOR A=53513 TO 53641 STEP 32
 20060 POKE A,161:NEXT A
 20065 POKE 53545,32
 20070 FOR A=53579 TO 53643 STEP 32
 20080 POKE A,161:NEXT A
 20090 FOR A=53581 TO 53709 STEP 32
 20100 POKE A,161:NEXT A
 20110 POKE 53580,161:POKE 53644,161:
       POKE 53708,161
 20140 FOR A=53519 TO 53647 STEP 32
 20150 POKE A,161:NEXT A
 20160 FOR A=53585 TO 53649 STEP 32
 20170 POKE A,161:NEXT A
 20180 POKE 53584,161
 20190 FOR A=53524 TO 53652 STEP 32
 20200 POKEA,161:NEXT A
 20210 POKE 53523,161:POKE 53525,161
 20230 FOR E=1 TO 500:NEXT E
 20240 X=USR(X)
 20250 RETURN
OK
```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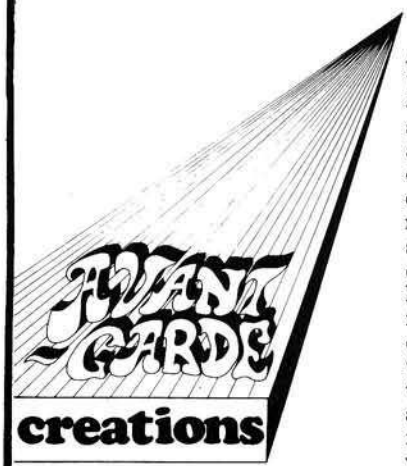

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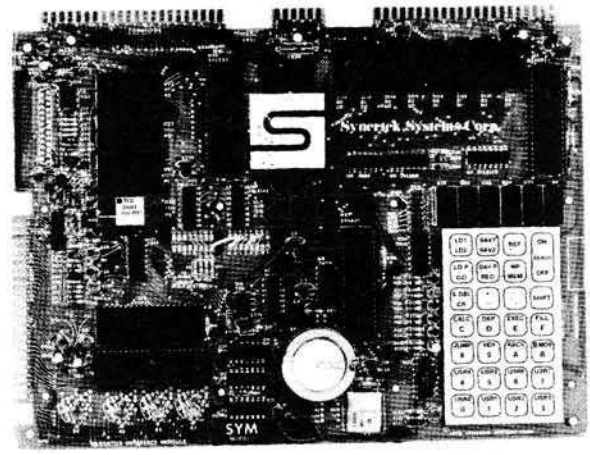

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SYMple BASIC Data Files

The SYM-1 has a Microsoft BASIC available in ROM. Data Save and Data Load via the cassette are NOT supported by this version. The routines required to implement these two important functions are presented here.

John M. Blalock
3054 West Evans Drive
Phoenix, AZ 85023

If you've read "A SYMple Memory Expansion" in the August 1979 issue of MICRO and "Another KIM Expansion" in the September 1979 issue of *Kilobaud Microcomputing*, then you know that I like Micro-Z's BASIC for the KIM. You will also know that I have the Synertek BAS-1 BASIC for the SYM. Both versions were written by Microsoft, have 9-digit decimal accuracy, etc. but differ in some of their functions.

Comparing the Micro-Z Synertek BASICS

Synertek BASIC has a more convenient USR function and a &"hex" function that are definite improvements over the original BASIC. Their ROM version has no GET function like Micro-Z's. Another difference is that a response of a carriage return only to an INPUT statement will cause a break in program execution with Synertek's BASIC. Micro-Z has supplied a patch to defeat this break. The Synertek ROM does not include any trig functions, but they have recently released Technical Note #53-SSC that gives you full trig capability using only 313 bytes of RAM.

The main difference between the two BASICs, then, is the data save/data load feature added to his version by Bob Kurtz of Micro-Z. This is a very valuable feature that Microsoft left out. BASIC can not be used to maintain any types of files such as mailing lists, inventory records, or financial records without this feature. Perhpaps you could enter the data via DATA statements, but that would be a very trying task indeed! This feature is the major reason that I have preferred Micro-Z's BASIC over Synertek's.

Data Save/Data Load for Synertek BASIC

Listings 1, 2, and 3 are my first attempts to provide the same data save/data load functionality for the SYM with BAS-1. Listing 1 is just BASIC initialization, program loading, and a LIST of the program. All terminal input has been underlined for clarity. The little crooked arrows represent a carriage return typed in.

Listing 2 is a RUN of the program showing the means used to save the data. Three separate records are saved; the page zero pointers, the numeric data and string pointers, and the string data itself. To reload this data, BASIC must be initialized with the same memory size and the program can not have been modified.

Listing 3 is another RUN of the program after memory was cleared and the program reloaded. The data saved in listing 2 was restored, as can be seen. No, it is not as convenient as Bob Kurtz's method, but it works! Bob packs all the data together with a machine language subroutine and save it as one record. Another subroutine loads the combined record and then unpacks it, moving the data back to its original locations.

Machine Language Version of Data Save/Data Load

Listing 4 is a machine language subroutine that will save and load BASIC data files without having to turn control over to the SYM monitor. The data is still saved in three separate records, but they are recorded/loaded one right after another by the routine. An extra few seconds for each save or load (for sync, etc.) shouldn't hurt anyone, should it?

Listing 5 is a VERIFY dump of the subroutine. Load it in, VERIFY between the same addresses, and if you check sums match mine then you keyed it in correctly. Now we know why Synertek put those check sums on the VERIFY dumps! The rest of listing 5 shows BASIC initialization and the loading of the revised BASIC program.

Listing 6 is just a LIST of the revised program. Note the memory size was specified to allow room for the machine language subroutine which is called by statements 100 and 400. With either of the two methods, put the call to the load routine after any DIM statements and before the main program body. The call to the save routine should be at the very end of the program, as shown. Any changes to the program that increases the memory size needed for it will prevent data saved by a prior version from being loaded correctly.

Listing 7 is a RUN of the revised program wherein the data that is entered is saved at the end of the RUN. Listing 8 shows memory being cleared, BASIC initialization identical to that used in listing 7, and then the BASIC program being reloaded. The RUN of the program loads the data saved in listing 7.

If you plan on saving and loading data files very often, dedicating 148 bytes of memory to this subroutine should pay for itself in convenience over the method given earlier.

SYMple Memory Expansion Update

Regular readers of MICRO will recognize from the listings that my SYMple memory expansion board is still work-

Listing 4

```
                        ;
                        ;       ***  SAVER  ***
                        ;
                        ;
                        ; Routine to save and load SYM BASIC data tables.
                        ;
                        ; Initialize BASIC with MEMORY SIZE? = 8043 for an 8K SYM.
                        ; Call data load routine with "Q = USR(8136,384)" after
                        ; any DIM statements, but before any processing.
                        ; Call data save routine with "Q = USR(8044,384)" after
                        ; all data processing in the program has been done.
                        ; Always initialize BASIC with the same values and don't
                        ; alter the program or the data will not load properly.
                        ; The code is completely relocatable, only the MEMORY SIZE
                        ; and USR addresses must be changed for other locations.
                        ;
                        ;
                        ; Written by John M. Blalock, August 24, 1979
                        ;
                        ;
                        ; Routine and pointer addresses
                        ;
A64C                    SAD:    equ     $A64C   ; tape starting address
A64A                    EAD:    equ     $A64A   ; tape ending address + 1
A64E                    ID:     equ     $A64E   ; tape record identifier
7D                      BOD:    epz     $7D     ; beginning of data
81                      EOD:    epz     $81     ; end of data + 1
83                      BOS:    epz     $83     ; beginning of strings
87                      EOS:    epz     $87     ; end of strings + 1
D3                      NXL:    epz     $D3     ; next line pointer
EE                      TMP:    epz     $EE     ; temporary data
8E87                    DUMPT:  equ     $8E87   ; SYM tape save routine
8C78                    LOADT:  equ     $8C78   ; SYM tape load routine
8188                    SAVER:  equ     $8188   ; SYM register save routine
81C4                    RESALL: equ     $81C4   ; restores registers & returns
8A47                    OUTCHR: equ     $8A47   ; SYM terminal output routine
                        ;
                        ; Data save routine
                        ;
                                org     $1F6C   ; 8044 decimal
1F6C:20 88 81           SAVE:   JSR     SAVER   ; save all registers
1F6F:8D 4E A6                   STA     ID      ; ID passed in A
1F72:A9 00                      LDA     #00     ; clear accum
1F74:8D 4D A6                   STA     SAD+1   ; SA and EA are on
1F77:8D 4B A6                   STA     EAD+1   ;  page zero
1F7A:A9 65                      LDA     #$65    ; will start at $0065
1F7C:8D 4C A6                   STA     SAD     ;  and record
1F7F:A9 EA                      LDA     #$EA    ;   all pointers, etc.
1F81:8D 4A A6                   STA     EAD     ;    thru $00E9
1F84:20 87 8E                   JSR     DUMPT   ; save it, mode passed in Y
1F87:20 FA 1F                   JSR     DOT     ; send asterisk to terminal
1F8A:A0 80                      LDY     #$80    ; mode = HS
1F8C:A5 7D                      LDA     BOD     ; set up tape
1F8E:8D 4C A6                   STA     SAD     ;  addresses
1F91:A5 7E                      LDA     BOD+1   ;
1F93:8D 4D A6                   STA     SAD+1   ;
1F96:A5 81                      LDA     EOD     ;
1F98:8D 4A A6                   STA     EAD     ;
1F9B:A5 82                      LDA     EOD+1   ;
1F9D:8D 4B A6                   STA     EAD+1   ;
1FA0:EE 4E A6                   INC     ID      ; second record
1FA3:20 87 8E                   JSR     DUMPT   ; save it
1FA6:20 FA 1F                   JSR     DOT     ; print another asterisk
1FA9:A0 80                      LDY     #$80    ; mode = HS
1FAB:A5 83                      LDA     BOS     ; set up tape addresses
1FAD:8D 4C A6                   STA     SAD     ;  for string data
1FB0:A5 84                      LDA     BOS+1   ;
1FB2:8D 4D A6                   STA     SAD+1   ;
1FB5:A5 87                      LDA     EOS     ;
1FB7:8D 4A A6                   STA     EAD     ;
1FBA:A5 88                      LDA     EOS+1   ;
1FBC:8D 4B A6                   STA     EAD+1   ;
1FBF:EE 4E A6                   INC     ID      ; third record
1FC2:20 87 8E                   JSR     DUMPT   ; save it
1FC5:4C C4 81                   JMP     RESALL  ; restore regs & return
                        ;
                        ; Data load routine
                        ;
1FC8:20 88 81           LOAD:   JSR     SAVER   ; save all registers
1FCB:8D 4E A6                   STA     ID      ; ID passed in A, mode in Y
1FCE:A5 D3                      LDA     NXL     ; put next line pointers
1FD0:85 EE                      STA     TMP     ;  in a spare location
1FD2:A5 D4                      LDA     NXL+1   ;   that won't be altered -
1FD4:85 EF                      STA     TMP+1   ;    will need to continue.
1FD6:20 78 8C                   JSR     LOADT   ; load first record
1FD9:20 FA 1F                   JSR     DOT     ; send asterisk to terminal
1FDC:A0 80                      LDY     #$80    ; mode = HS
1FDE:EE 4E A6                   INC     ID      ; second record
1FE1:20 78 8C                   JSR     LOADT   ; load it
1FE4:20 FA 1F                   JSR     DOT     ; print another asterisk
1FE7:A0 80                      LDY     #$80    ; mode = HS
1FE9:EE 4E A6                   INC     ID      ; third record
1FEC:20 78 8C                   JSR     LOADT   ; load it
1FEF:A5 EE                      LDA     TMP     ; restore next line
1FF1:85 D3                      STA     NXL     ;  pointers so that
1FF3:A5 EF                      LDA     TMP+1   ;   BASIC can continue
1FF5:85 D4                      STA     NXL+1   ;    from where it was.
1FF7:4C C4 81                   JMP     RESALL  ; restore regs & return
                        ;
                        ; Subroutine to print an asterisk on the terminal so that
                        ; the operator doesn't doze off, or think the SYM has.
                        ;
1FFA:A9 2A              DOT:    LDA     #$2A    ; ASCII asterisk
1FFC:20 47 8A                   JSR     OUTCHR  ; send to terminal
1FFF:60                         RTS             ; and return
```

Listing 5

```
.V 1F6C-1FFF
1F6C 20 88 81 8D 4E A6 A9 00-53
1F74 8D 4D A6 8D 4B A6 A9 65-5F
1F7C 8D 4C A6 A9 EA 8D 4A A6-EE
1F84 20 87 8E 20 FA 1F A0 80-7C
1F8C A5 7D 8D 4C A6 A5 7E 8D-CD
1F94 4D A6 A5 81 8D 4A A6 A5-08
1F9C 82 8D 4B A6 EE 4E A6 20-0A
1FA4 87 8E 20 FA 1F A0 80 A5-1D
1FAC 83 8D 4C A6 A5 84 8D 4D-22
1FB4 A6 A5 87 8D 4A A6 A5 88-9E
1FBC 8D 4B A6 EE 4E A6 20 87-A5
1FC4 8E 4C C4 81 20 88 81 8D-7A
1FCC 4E A6 A5 D3 85 EE A5 D4-D2
1FD4 85 EF 20 78 8C 20 FA 1F-A3
1FDC A0 80 EE 4E A6 20 78 8C-C9
1FE4 20 FA 1F A0 80 EE 4E A6-04
1FEC 20 78 8C A5 EE 85 D3 A5-B8
1FF4 EF 85 D4 4C C4 81 A9 2A-64
1FFC 20 47 8A 60-B5
 4CB5
```

Listing 6

```
LIST

 10 REM   SYM DATA SAVE/LOAD DEMO PROGRAM
 20 REM       JOHN BLALOCK        AUGUST 24, 1979
 30 DIM A(100), B$(100):N = 0
 40 PRINT CHR$(12);:FOR I = 1 TO 200:NEXT I
 50 PRINTTAB(30)"DATA SAVE/LOAD DEMO":PRINT:PRINT:PRINT
 60 INPUT"DO YOU WANT TO RESTORE PRIOR SAVED DATA? ";Q$
 80 IF LEFT$(Q$,1) <> "Y" THEN 200
 90 PRINT:PRINT"START RECORDER ON PLAYBACK.":PRINT
 100 Q = USR(8136,384)
 110 PRINT:PRINT"DATA LOADED.":PRINT
 120 FOR I = 1 TO 1000:NEXT I
 200 PRINT CHR$(12);:FOR I = 1 TO 200:NEXT I:PRINT
 210 PRINT"ENTER PAY NUMBER AND NAME, SEPARATED BY A COMMA:"
 220 PRINT "FOR EXAMPLE; '12345,JOHN SMITH'"
 230 PRINT"ENTER A NEGATIVE NUMBER (-1) AS A PAY NUMBER TO END
 240 PRINT                                                ENTRY."
 250 FOR I = N+1 TO 100
 260 INPUT A(I),B$(I)
 270 IF A(I) < 0 THEN N = I-1 :GOTO 300
 280 NEXT I:PRINT"TABLE IS FULL!"
 290 N = I
 300 PRINT"THE TABLE NOW CONTAINS THE FOLLOWING DATA:"
 310 PRINT" #         PAY NUMBER         NAME"
 320 FOR I = 1 TO N
 330 PRINT I TAB(11) A(I) TAB(27) B$(I)
 340 NEXT I
 350 PRINT:PRINT:PRINT
 360 INPUT"DO YOU WANT TO SAVE THIS DATA? ";Q$
 370 IF LEFT$(Q$,1) <> "Y" THEN PRINT:PRINT"PROGRAM ENDS.":END
 380 PRINT:PRINT:PRINT
 390 INPUT"START RECORDER ON RECORD, THEN ENTER 'G CR'.  ";Q$
 400 Q = USR(8044,384)
 410 PRINT:PRINT"DATA SAVED.":PRINT:PRINT"PROGRAM ENDS.":END
OK
```

Listing 7

```
RUN
                                   DATA SAVE/LOAD DEMO
DO YOU WANT TO RESTORE PRIOR SAVED DATA? NO

ENTER PAY NUMBER AND NAME, SEPARATED BY A COMMA:
FOR EXAMPLE; '12345,JOHN SMITH'
ENTER A NEGATIVE NUMBER (-1) AS A PAY NUMBER TO END ENTRY.
? 12345-JOHN SMITH
? 23456,JANE JONES
? 34567,MARY JOHNSON
? -1.
THE TABLE NOW CONTAINS THE FOLLOWING DATA:
 #         PAY NUMBER         NAME
 1           12345           JOHN SMITH
 2           23456           JANE JONES
 3           34567           MARY JOHNSON
DO YOU WANT TO SAVE THIS DATA? YES
START RECORDER ON RECORD, THEN ENTER 'G CR'.  G
**
DATA SAVED.

PROGRAM ENDS.



.F 00-00-F0
.F 00-200-1FFF
.L2 01
.J 0
MEMORY SIZE? 8043
WIDTH?

 7530 BYTES FREE

BASIC V1.1
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OK
LOADT
LOADED
OK
RUN
                                   DATA SAVE/LOAD DEMO
DO YOU WANT TO RESTORE PRIOR SAVED DATA? YES

START RECORDER ON PLAYBACK.

**
DATA LOADED.
ENTER PAY NUMBER AND NAME, SEPARATED BY A COMMA:
FOR EXAMPLE; '12345,JOHN SMITH'
ENTER A NEGATIVE NUMBER (-1) AS A PAY NUMBER TO END ENTRY.

? 44444,JAMES BOND
? 44444,ALLEN SMITH
? -1,
THE TABLE NOW CONTAINS THE FOLLOWING DATA:
 #         PAY NUMBER         NAME
 1           12345           JOHN SMITH
 2           23456           JANE JONES
 3           34567           MARY JOHNSON
 4           44444           JAMES BOND
 5           44444           ALLEN SMITH
DO YOU WANT TO SAVE THIS DATA? NO

PROGRAM ENDS.

OK
```
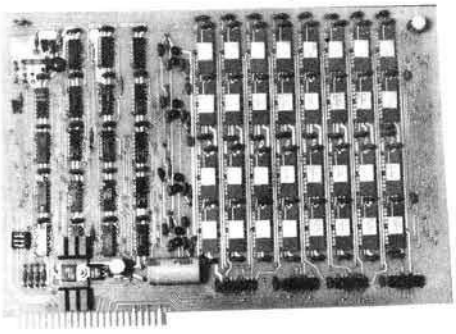

16K MEMORY



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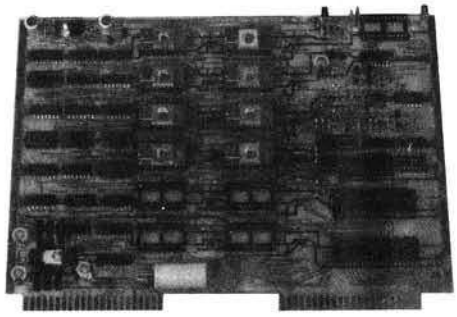

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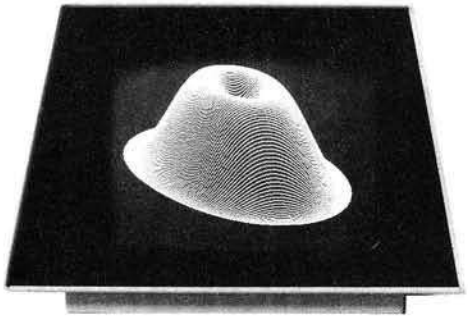

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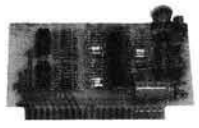

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A Perpetual Calendar Printer for the AIM

If you know the proper tricks, a Perpetual Calander is quite easy to program. Here it is presented for the AIM 65. In addition to being an interesting demonstration, it points out a few programming tricks required when using integer numbers in BASIC.

Mel Evans
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Ann Arbor, MI 48103

Another calendar printer? Yes, but with a couple of new twists. First, it puts out to the AIM printer. So the next time someone asks, "Okay, but what can it actually do?," you can give him an answer he can put in his pocket and take home with him.

Second, it has a built-in perpetual-calander algorithm that finds the starting day-of-the-week for any month of any year from 1583 AD (the start of the Gregorian calendar) to 999999999 AD (or until we change the calendar, or until the world ends, whichever comes first.) The algorithm is fairly simple, but the results can be impressive. For example:

```
RUN
HOW MANY MONTHS? 1
MONTH #? 7
YEAR? 1776


***** JULY  1776 ***
 S  M  T  W  T  F  S
       1  2  3  4  5  6
 7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31
```

"So, Independence Day happened on a Thursday."

"You mean it figured out all those leap years clear back to 1776?"

"Well, the equivalent of that, yes."

"How do I know it's right?"

"You don't."

"Okay, print me December, 1941. I know what day Pearl Harbor happened on."

```
RUN
HOW MANY MONTHS? 1
MONTH #? 12
YEAR? 1941

** DECEMBER 1941 ***
 S  M  T  W  T  F  S
       1  2  3  4  5  6
 7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31
```

"So December 7th was a Sunday."

"Hey, that's right! Okay, print me the start of year 2000."

```
RUN
HOW MANY MONTHS? 2
FIRST MONTH #? 1
YEAR? 2000

*** JANUARY 2000 ***
 S  M  T  W  T  F  S
                   1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31

** FEBRUARY 2000 ***
 S  M  T  W  T  F  S
       1  2  3  4  5
 6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29
```

"How about that! It got February right. Century years aren't normally leap years, but every fourth century is, and there it is."

"Right. Want a calendar of this month, and may;be the rest of the year?"

"Sure, but make it through next February. Why do all calendars end at December?"

"I don't know, but this one won't."

```
RUN
HOW MANY MONTHS? 5
FIRST MONTH #? 10
YEAR? 1979

*** OCTOBER 1979 ***
 S  M  T  W  T  F  S
       1  2  3  4  5  6
 7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31

** NOVEMBER 1979 ***
 S  M  T  W  T  F  S
             1  2  3
 4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30

** DECEMBER 1979 ***
 S  M  T  W  T  F  S
                   1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31
```

```
*** JANUARY 1980 ***
 S  M  T  W  T  F  S
          1  2  3  4  5
 6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31

** FEBRUARY 1980 ***
 S  M  T  W  T  F  S
                1  2
 3  4  5  6  7  8  9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29
```

The day-of-the-week algorithm appeared in **BYTE** (Day of Week and Elapsed Time Programs," W. B. Agocs, **BYTE**, September, 1979, p. 126.). I read it, thought "That's neat," and forgot it. Then a calendar printing program for Teletype came out in **Kilobaud** ("Calendar Program," Steve Tabler, **Kilobaud Microcomputing**, October 1979, p. 102.). Can the AIM do that on its printer? Sure it can! Can I build in that day-of-week algorithm so that it doesn't need starting instructions? Sure I can! The resulting AIM BASIC program is listed in Figure 1.

The starting day-of-week algorithm is in lines 85 through 150. It uses "Zeller's congruence," as explained in Agoc's article. Zeller first does some juggling of month and year numbers before getting down to the main computation of the day-of-week (variable DW in line 150).

The algorithm packs more power than I needed here; it works for any year, month, and day-of-month (day-of-month is variable DM in line 130). Since I only needed the beginning day-of-week of each month to be printed, I set DM = 1 in line 129. To restore the algorithm to its full power, just delete that one statement, and use DM as an input.

AIM BASIC (like most BASICs) does not allow much format flexibility in printing numbers, so to squeeze those date-lines onto the 20-column printer, a string variable, L$, is used to build each line before printing. L$ is first nulled (e.g., line 290), and is then built up, character by character, as in line 350:

L$ = L$ + CHR$(48 + D2)

This statement adds D2, the second (units) digit of a two-digit date number, to line L$. As shown in Appendix E of the AIM BASIC manual, CHR$(48) is ASCII "0" (zero), and the other digits follow. So, if D2 = 5, say, ASCII "5" is added to the string. After the last character has been added, the line is printed (e.g., line 380).

If you are fussy about format, the above technique gives you total control over each column of each line. If numbers don't print to suit you; don't print numbers, print characters.

AIM BASIC has one quirk which I haven't noticed in others (but if you're running a different BASIC, you might like to check it out). If X evaluates internally as less than an integer, but is sufficiently close to that integer, it will print as the integer, but INT(X) will truncate down to the next-lower integer; e.g., if X = 4.99999...,you get:

```
PRINT X
 5
PRINT INT (X)
 4
```

Don't believe it? Try this:

```
LIST
 20 X=5
 30 Y=X/3
 40 Z=Y*X/3
 50 X=3*3*Z/X
 60 PRINT "X=";X;" I
NT(X)=";INT(X)
 70 END

RUN
X= 5   INT(X)= 4
```

To prevent this from happening, add a dab to X before doing INT(X). How much is a dab? Anything less than the smallest meaningful increment in X. The first equation in line 258, for example, is computing the century from the year:

C = INT(Y/100 + .005)

If year Y increases by 1, Y/100 increases by .01, so the added dab is half that. This assures that it will work for the year 2000, and is small enough so it will also work for 1999.

Another example is on Line 262:

INT(YC/4 + .1).

When YC increments by one, YC/4 increases by .25, and the added dab is less than half that. The previous .005 would work fine here, too, but .1 costs fewer bytes.

A final note of minor interest. Line 80 sends two line-feeds to the printer before starting the calendar, and line 430 sends it five line-feeds, so you can tear off the finished calendar without having to pump th "LF" key. And PRINT TAB (100) is sure neater than a string of five PRINT statements, isn't it?

```
LIST
 4 REM
 5 REM   PERPETUAL-
   CALENDAR PRINTER
 6 REM
 10 DIM A(12),R$(12)
 20 FOR I=1 TO 12:RE
AD A(I):NEXT I
 30 FOR I=1 TO 12:RE
AD R$(I):NEXT I
 40 INPUT "HOW MANY
MONTHS";N
 50 IF N=1 THEN INPU
T "MONTH #";M
 60 IF N>1 THEN INPU
T "FIRST MONTH #";M
 70 INPUT "YEAR";Y
 80 PRINT TAB(40)
 85 REM  CONVERT TO
 ZELLER MONTH & YEAR
 90 MZ=M-2:YZ=Y
 100 IF M=1 THEN MZ=
11:YZ=Y-1
 110 IF M=2 THEN MZ=
12:YZ=Y-1
 115 REM   FIND
STARTING DAY-OF-WEEK
 120 CZ=INT(YZ/100+.
005):YZ=YZ-100*CZ:DM
=1
 130 D1=INT(2.6*MZ-.
1)+DM+YZ
 140 D1=D1+INT(YZ/4+
.1)+INT(CZ/4+.1)-2*C
Z
 150 DW=D1-7*INT(D1/
7+.01)+1
 155 REM PRINT HEADE
R
 160 PRINT R$(M);:PR
INT Y;:PRINT"***"
 170 PRINT" S  M  T
  W  T  F  S"
 175 REM BUILD FIRST
   DATE-LINE & PRINT
 180 L$="":D1=DW-.5
 190 FOR I=1 TO 7
 200 DT=I-DW+1
 210 IF I<D1 THEN L$
=L$+"   "
 220 IF I>D1 THEN L$
=L$+" "+CHR$(48+DT)
 230 IF I<6.5 THEN L
$=L$+" "
```

```
 240 NEXT I
 250 PRINT L$
 255 REM  CHECK FOR
       LEAP-YEAR
 258 C=INT(Y/100+.00
5):YC=Y-100*C
 260 A(2)=28
 262 IF YC=4*INT(YC/
4+.1) THEN A(2)=29
 264 IF YC<.5 THEN A
(2)=28
 270 IF YC<.5 AND C=
4*INT(C/4+.1) THEN A
(2)=29
 275 REM   BUILD
REMAINING DATE-LINES
       AND PRINT
 280 EN=0
 290 L$=""
 300 FOR I=1 TO 7
 310 DT=DT+1:IF DT>A
(M)+.5 THEN EN=1:GOT
O 380
 320 D1=INT(DT/10+.0
5):D2=DT-10*D1
 330 IF D1<.5 THEN L
$=L$+" "
 340 IF D1>.5 THEN L
$=L$+CHR$(48+D1)
 350 L$=L$+CHR$(48+D
2)
 360 IF I<6.5 THEN L
$=L$+" "
 370 NEXT I
 380 PRINT L$
 390 IF EN<.5 THEN 2
90
 400 PRINT" "
 405 REM   DO AGAIN
       FOR NEXT MONTH
 410 M=M+1:IF M>12.5
 THEN M=1:Y=Y+1
 420 N=N-1:IF N>.5 T
HEN 90
 430 PRINT TAB(100)
 440 END
 450 REM DATA: MONTH
   LENGTHS AND NAMES
 460 DATA 31,28,31,3
0,31,30,31,31,30,31,
30,31
 470 DATA *** JANUAR
Y,** FEBRUARY,**** M
ARCH
 480 DATA **** APRIL
 ,***** MAY  ,*****
JUNE
 490 DATA ***** JULY
 ,**** AUGUST,* SEPT
EMBER
 500 DATA *** OCTOBE
R,** NOVEMBER,** DEC
EMBER
```


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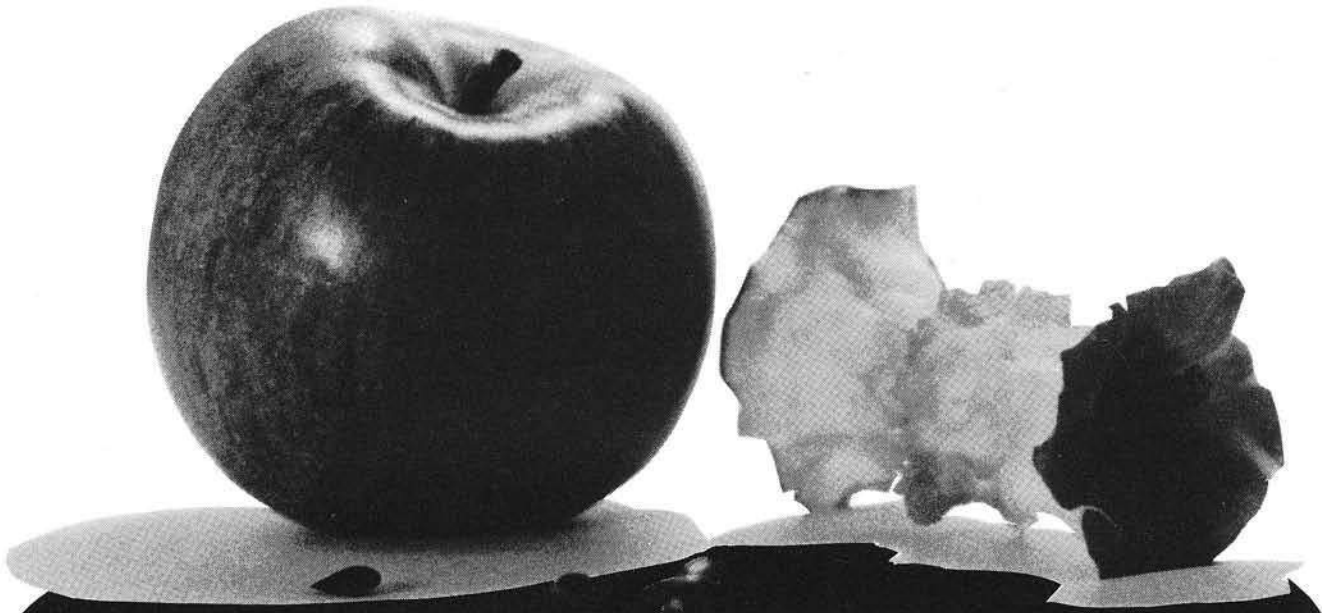

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Bi-Directional Scrolling

Everyone knows that a teletype only moves the paper in one direction - up. Likewise, the Apple display only scrolls one way - up. Now you can have scrolling in both directions - up and down - with these routines..

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By using the machine language routines given below, it is possible to scroll either text/gr page in either direction.

The up-scroll routine is derived from APPLE computer's red Reference Manual with the difference being that a zero-page location is referred to determine which page to scroll. The down scroll routine makes similar use of the same zero-page byte.

To use the routine a few entry conditions must be met:

1. Load the binary routine into the $300 page of memory starting at $300.

2. Set pointers 6,7, and 8,9. If you want to bring new information onto the screen from RAM as you scroll 6,7 must point to the location in memory where the data to be loaded onto the top line of the screen will come from when you scroll the screen page down. Similarly 8,9 point to the place in memory to get the data for the bottom line when you scroll up.

If you want to use this routine to directly view memory, the easiest way to set the pointers 6,7 and 8,9 is to set 8 and 9 to the address you want to start viewing at. Put the low order byte in 8 and the high order in 9. (The screen height plus 1.) Then set 6,7 to the same value as 8,9 were originally, i.e., the low and high byte bring the starting address. Last of all, scroll back down one line to bring the starting address line into position as the first line of text visible at the top of the screen.

If you do not want new data brought onto the screen, then 6,7 and 8,9 will have

```
 10 LOMEM:3072
 20 REM OR SET LOMEM: MANUALLY          BEFORE RUNNING.
 30 CALL -936: INPUT "PAGE 1 OR 2?",PAGE
 40 PRINT "INPUT ADDRESS ( < 32767) TO START AT:": INPUT A
 50 REM TO SCROLL WITHOUT BRINGING IN NEW DATA ENTER '0' FOR ADDRESS.
 60 IF A#0 THEN 100: TEXT : CALL -936: POKE 34,1: REM FREEZE ONE BLANK LINE AT TOP OF SCREEN
 70 VTAB 12: PRINT "(SAMPLE PG.1 SCREEN DATA)"
 80 POKE 6,0: POKE 7,4: POKE 8,0: POKE 9,4: REM BRING NEW SCREEN DATA FROM THAT BLANK LINE
 90 GOTO 150
100 LB=A MOD 256:HB=A/256
110 POKE 5,PAGE*4: IF PAGE=2 THEN POKE -16299,0
120 POKE 8,LB: POKE 9,HB
130 FOR I=1 TO 25: CALL 768: NEXT I
140 POKE 6,LB: POKE 7,HB
150 KEY= PEEK (-16384): POKE -16368,0
160 IF KEY=149 THEN CALL 768: REM RT. ARROW KEY TO SCROLL UP
170 IF KEY=136 THEN CALL 845: REM LFT. ARROW KEY TO SCROLL DOWN
180 IF KEY#136 AND KEY#149 OR A#0 THEN 190: POKE 6,0: POKE 7,4: POKE 8,0: POKE 9,4: REM RESET 6,7 & 8,9 TO POINT AT B
    LANK LINE
190 IF KEY#177 THEN 200: POKE 5,4: POKE -16300,0: REM '1' FOR PAGE 1
200 IF KEY#178 THEN 210: POKE 5,8: POKE -16299,0: REM '2' FOR PAGE 2
210 IF KEY#216 THEN 150: POKE -16300,0: TEXT : CALL -868: PRINT "BYE.": END
```

```
 1 ********************************
 2 *                              *
 3 *    APPLE SCROLLING ROUTINE   *
 4 *                              *
 5 *            BY                *
 6 *        ROGER WAGNER          *
 7 *                              *
 8 *   THIS WILL LET EITHER PAGE  *
 9 * SCROLL IN EITHER DIRECTION.  *
10 *   IT IS PRIMARILY DESIGNED   *
11 * TO FEED NEW SCREEN DATA IN   *
12 * FROM A GIVEN RANGE OF RAM.   *
13 *                              *
14 ********************************
15 *
16 *
17 *
18       OBJ   $300
19       ORG   $300
20 WNDLFT EQU   $20
21 WNDWDTH EQU   $21
22 WNDTOP EQU   $22
23 WNDBTM EQU   $23
24 CH    EQU   $24
25 CV    EQU   $25
26 BASL  EQU   $28
27 BASH  EQU   $29
28 BAS2L EQU   $2A
29 BAS2H EQU   $2B
30 PAGE  EQU   $05
31 * FOR APPLESOFT USE PAGE EQU $1F
32 * PAGE MUST HOLD $04 FOR PG. 1,
33 * $08 FOR PG. 2
34 SCRNTP EQU   $06
35 * $06,$07 = LO/HI BYTES
36 * OF START OF LINE JUST BEFORE
37 * TOP LINE
38 SCRNBTM EQU   $08
39 * $08,$09= LO/HI BYTES
40 * OF START OF LINE JUST AFTER
41 * BOTTOM LINE
42 *
43 *
```

0300 A5 22
0302 48
0303 20 9E 03
0306 A5 28
0308 85 2A
030A A5 29
030C 85 2B
030E A4 21
0310 88
0311 68
0312 69 01
0314 C5 23
0316 B0 0D
0318 48
0319 20 9E 03
031C B1 28
031E 91 2A
0320 88
0321 10 F9
0323 30 E1
0325 A0 00
0327 B1 08
0329 91 28
032B C8
032C C4 21
032E 90 F7
0330 18
0331 A5 06
0333 65 21
0335 85 06
0337 A5 07
0339 69 00
033B 85 07
033D 18
033E A5 08
0340 65 21
0342 85 08
0344 A5 09
0346 69 00
0348 85 09
034A 4C 9C 03

```
44 SCROLL LDA   WNDTOP
45        PHA
46        JSR   VTABZ
47 NXTLN LDA   BASL
48        STA   BAS2L
49        LDA   BASH
50        STA   BAS2H
51        LDY   WNDWDTH
52        DEY
53        PLA
54        ADC   #$01
55        CMP   WNDBTM
56        BCS   LDBTM
57        PHA
58        JSR   VTABZ
59 NXTCHR LDA   (BASL),Y
60        STA   (BAS2L),Y
61        DEY
62        BPL   NXTCHR
63        BMI   NXTLN
64 LDBTM LDY   #00
65 LD2   LDA   (SCRNBTM),Y
66        STA   (BASL),Y
67        INY
68        CPY   WNDWDTH
69        BCC   LD2
70 CRRCT CLC
71        LDA   SCRNTP
72        ADC   WNDWDTH
73        STA   SCRNTP
74        LDA   SCRNTP+1
75        ADC   #00
76        STA   SCRNTP+1
77        CLC
78        LDA   SCRNBTM
79        ADC   WNDWDTH
80        STA   SCRNBTM
81        LDA   SCRNBTM+1
82        ADC   #00
83        STA   SCRNBTM+1
84        JMP   VTAB
85 *
86 *
87 SCROLLDN SEC
88        LDA   WNDBTM
89        SBC   #$01
90        PHA
91        JSR   VTABZ
92 NXTLN2 LDA   BASL
93        STA   BAS2L
94        LDA   BASH
95        STA   BAS2H
96        LDY   WNDWDTH
97        DEY
98        PLA
```

034D 38
034E A5 23
0350 E9 01
0352 48
0353 20 9E 03
0356 A5 28
0358 85 2A
035A A5 29
035C 85 2B
035E A4 21
0360 88
0361 68

```
99        SBC   #$00
100       CMP   WNDTOP
101       BMI   LDTOP
102       PHA
103       JSR   VTABZ
104 NXTCHR2 LDA   (BASL),Y
105       STA   (BAS2L),Y
106       DEY
107       BPL   NXTCHR2
108       BMI   NXTLN2
109 LDTOP LDY   #$00
110 LT2   LDA   (SCRNTP),Y
111       STA   (BASL),Y
112       INY
113       CPY   WNDWDTH
114       BCC   LT2
115 CRRCT2 SEC
116       LDA   SCRNTP
117       SBC   WNDWDTH
118       STA   SCRNTP
119       LDA   SCRNTP+1
120       SBC   #00
121       STA   SCRNTP+1
122       SEC
123       LDA   SCRNBTM
124       SBC   WNDWDTH
125       STA   SCRNBTM
126       LDA   SCRNBTM+1
127       SBC   #00
128       STA   SCRNBTM+1
129       RTS
130       BRK
131 *
132 *
133 VTAB  LDA   CV
134 VTABZ JSR   BASCALC
135       ADC   WNDLFT
136       STA   BASL
137       RTS
138 *
139 *
140 BASCALC PHA
141       LSR
142       AND   #$03
143       ORA   PAGE
144       STA   BASH
145       PLA
146       AND   #$18
147       BCC   BSCLC2
148       ADC   #$7F
149 BSCLC2 STA   BASL
150       ASL
151       ASL
152       ORA   BASL
153       STA   BASL
154 END   RTS
--- END ASSEMBLY ---
TOTAL ERRORS: 00
```

0362 E9 00
0364 C5 22
0366 30 0D
0368 48
0369 20 9E 03
036C B1 28
036E 91 2A
0370 88
0371 10 F9
0373 30 E1
0375 A0 00
0377 B1 06
0379 91 28
037B C8
037C C4 21
037E 90 F7
0380 38
0381 A5 06
0383 E5 21
0385 85 06
0387 A5 07
0389 E9 00
038B 85 07
038D 38
038E A5 08
0390 E5 21
0392 85 08
0394 A5 09
0396 E9 00
0398 85 09
039A 60
039B 00

039C A5 25
039E 20 A6 03
03A1 65 20
03A3 85 28
03A5 60

03A6 48
03A7 4A
03A8 29 03
03AA 05 05
03AC 85 29
03AE 68
03AF 29 18
03B1 90 02
03B3 69 7F
03B5 85 28
03B7 0A
03B8 0A
03B9 05 28
03BB 85 28
03BD 60

Change of Address?

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to point to a part of memory that contains 40 blank space characters. One way to do this is to freeze on blank line on either page 1 or 2, and then set 6, 7 and 8, 9 must be reset to that value each time the scroll is done. This is because normally the scroll routine updates 6,7 and 8,9 by thee screen width so as to remain synchronized with the screen display another technique is to just clear the top or bottom line to blanks each time a scroll is done.

3. Location 5 must hold a 4 for page 1 scrolling, and an 8 for page 2.

4. That's all. Now when you want the screen to scroll just 'CALL 768' to scroll up, and '845' to scroll down.

Special Notes:

If you are going to use page 2 of text/gr in Integer Basic, be sure to protect the variables with a 'LOMEM': 3072. This may be done before running the program, or if you know how, put as an early line in the program.

To use page 2 in Applesoft is more difficult, but can be done. First, location $3AB in the machine code must be changed from $05 to $1F. Also, you must POKE 31 with a 4 or 8 as compared to the POKE 5 in Interger.

The real rub is that Applesoft programs normally begin in memory at $800 (hex) which conflicts with page 2 use. The way around this is to do a 'POKE 104, 12: POKE 3072, 0' before loading your program. After loading do a 'CALL 54514' (unnecessary with DOS 32.). Unless you do a 'RESET', 'Control-B' other programs. Unfortunately, use of page 2 with the RAM version of Applesoft is to my knowledge impossible. (Sorry...)

If you wish to move the scrolling routine for some reason, the only location-dependent aspects of the code are 5 'JSR's and 1 'JMP' within it. Since these operations always reference absolute addresses they will have to be rewritten. Of course, if you have a relocate utility, it is that much easier.

For further enlightenment, see the sample Integer Basic program which makes use of the scrolling routine. Have Fun!

Location dependent:

$303:	JSR	$39E
319:	JSR	39E
34A:	JMP	39C
353:	JSR	39E
369:	JSR	39E
39E:	JSR	3A6

If page 2 of TEXT/GR is to be used, it must be protected by a 'LOMEM:3072' for integer BASIC, or a 'special Load' (as described in article) when using Applesoft.

Note: $3AB must be changed from $05 to $1F for Applesoft.

Symbol Table

WNDLFT	0020
WNDWDTH	0021
WNDTOP	0022
WNDBTM	0023
CH	0024
CV	0025
BASL	0028
BASH	0029
BAS2L	002A
BAS2H	002B
PAGE	0005
SCRNTP	0006
SCRNBTM	0008
SCROLL	0300
NXTLN	0306
NXTCHR	031C
LDBTM	0325
LD2	0327
CRRCT	0330
SCROLLDN	034D
NXTLN2	0356
NXTCHR2	036C
LDTOP	0375
LT2	0377
CRRCT2	0380
VTAB	039C
VTABZ	039E
BASCALC	03A6
BSCLC2	03B5
END	03BD

```
*300.3BF
0300- A5 22 48 20 9E 03 A5 28
0308- 85 2A A5 29 85 2B A4 21
0310- 88 68 69 01 C5 23 B0 0D
0318- 48 20 9E 03 B1 28 91 2A
0320- 88 10 F9 30 E1 A0 00 B1
0328- 08 91 28 C8 C4 21 90 F7
0330- 18 A5 06 65 21 85 06 A5
0338- 07 69 00 85 07 18 A5 08
0340- 65 21 85 08 A5 09 69 00
0348- 85 09 4C 9C 03 38 A5 23
0350- E9 01 48 20 9E 03 A5 28
0358- 85 2A A5 29 85 2B A4 21
0360- 88 68 E9 00 C5 22 30 0D
0368- 48 20 9E 03 B1 28 91 2A
0370- 88 10 F9 30 E1 A0 00 B1
0378- 06 91 28 C8 C4 21 90 F7
0380- 38 A5 06 E5 21 85 06 A5
0388- 07 E9 00 85 07 38 A5 08
0390- E5 21 85 08 A5 09 E9 00
0398- 85 09 60 00 A5 25 20 A6
03A0- 03 65 20 85 28 60 48 4A
03A8- 29 03 05 05 85 29 68 29
03B0- 18 90 02 69 7F 85 28 0A
03B8- 0A 05 28 85 28 60 FF FF
```


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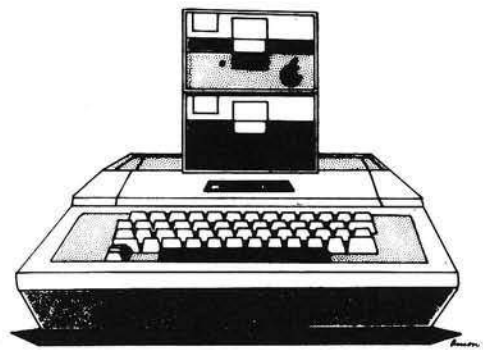

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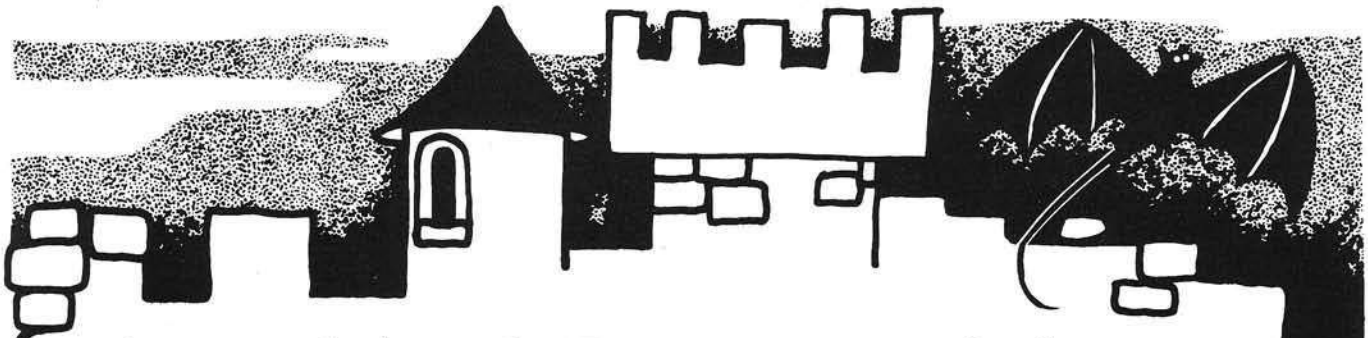

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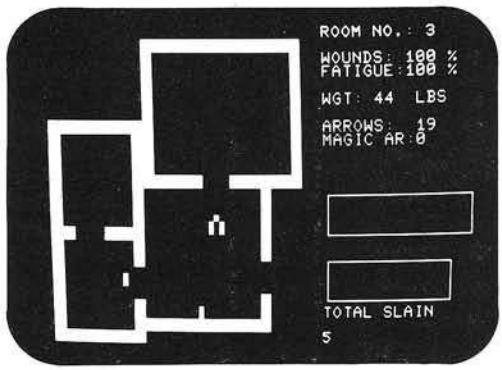

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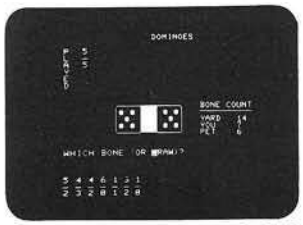

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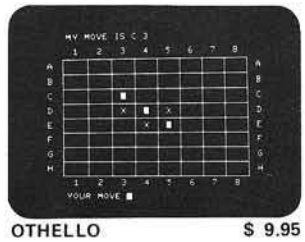

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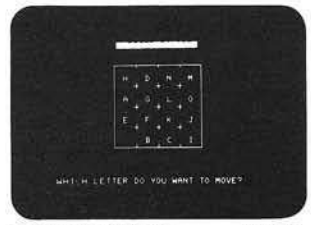

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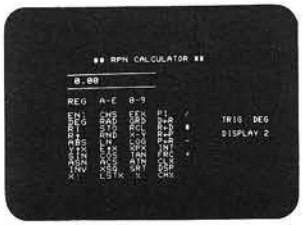

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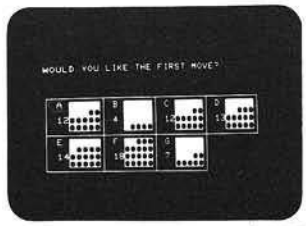

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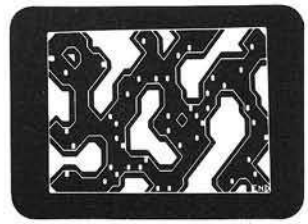

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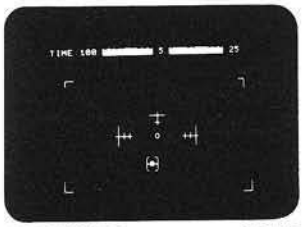

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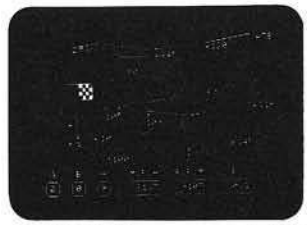

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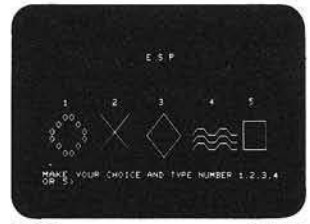

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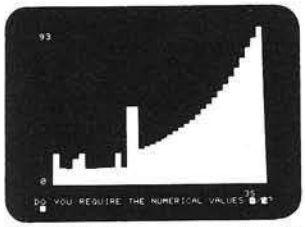

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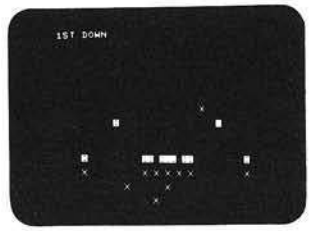

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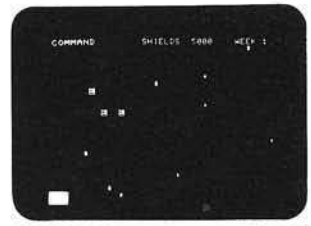

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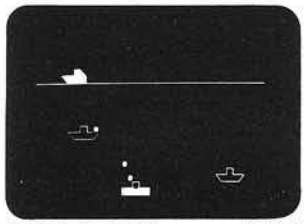

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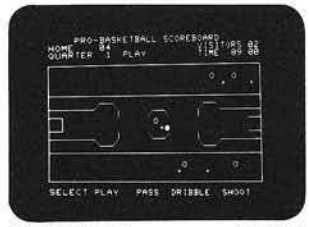

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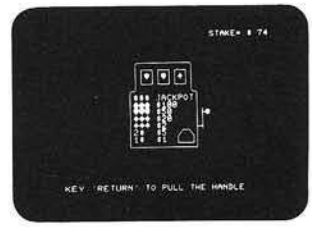

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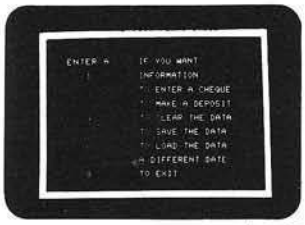

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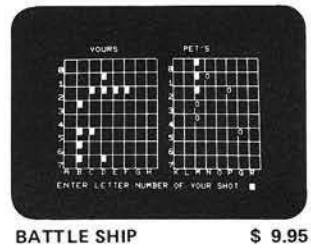

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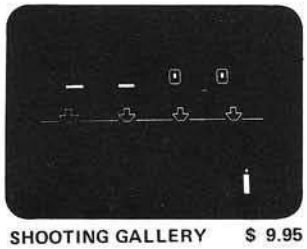

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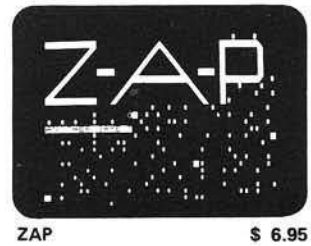

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The SY6516 Pseudo-16 Bit Processor

While the 6502 is a great microprocessor as it stands, advances are being considered to make it even better. One of the approaches is to add some new capabilities such as some 16 bit operations, improved addressing, and more.

Randall Hyde
12804 Magnolia
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For those of you who may have wondered what the 6502 equivalent of the MC6809 would be, wonder no longer. Synertek is almost ready to ship the SY6516.

Synertek announced the 6516 almost a year ago, but due to production problems, it never quite made it. The 6516 was designed by Atari Inc. (back then it was to be called the 6509) for use with the Atari 400 and 800 computer systems. Unfortunately, Synertek was unable to deliver the chip in time for Atari to use it in their computers.

What is a Pseudo 16-bit Computer?

A pseudo 16-bit computer uses an internal 16-bit register arrangement, but externally it uses an eight bit bus. Sixteen bit data is multiplexed in, much like the Alpha Micro computer on the S-100 bus. In addition to the new 16-bit instructions, the 6516 maintains all of the 8-bit instructions of the 6502. You may reassemble your source files currently on the 6502 and run them directly on the 6516. All the information that I have recieved says that the 6516 is SOURCE code compatable with the 6502 and that it is OBJECT code incompatable with the 6502. I have heard rumors that Synertek is attempting to make the 6516 object code compatable, but quite honestly, I don't believe there is much chance of it happening.

Unlike the Motorola MC6809, which has a distinct set of 8-bit instructions and a distinct set of 16-bit instructions, the SY6516 contains a special register (the "Q" register) which toggles the system back and forth between 8-bit operation and 16-bit operation. In addition, all registers in the 6516 (A, X, Y, and SP) are now 16-bits wide. The "Q" register contains four bits which may be programmed to put the accumulator in the 16-bit mode, the X-register in the 16-bit mode, the Y-register in the 16-bit mode, and memory in the 16-bit mode (for use with INC, DEC, ASL, ROL, ROR, LSR, etc.). If the accumulator is programmed to be in the 16-bit mode, then LDA will load the accumulator with 16-bits, the low order byte coming from the specified address and the high order byte coming from the specified address plus one. If the accumulator is in the 8-bit mode, then the LDA instruction behaves identically to the LDA on the 6502. The other registers (X, Y, and Memory) behave identically.

It does not take twice as long to perform a 16-bit instruction compared to the equivalent 8-bit instruction, as you might expect. Usually only one additional clock cycle is required. This means that 6516 code will run as much as 3 times faster than 6502 code performing the same operation.

In addition, several instructions have been "speeded up" over the 6502 equivalent. For instance, implied instructions now only require one cycle for complete execution (the 6502 requires 2). Several other instructions have been speeded up as well (see Table One).

Variety of addressing modes is what makes the 6502 as flexible as it is. The 6516 includes many more addressing modes in its instruction set. In particular, indirect addressing (without the indexed by Y or preindexed by X), 16-bit relative addressing (there is now a jump relative, so your code can be relocatable), and direct page addressing.

Direct page addressing is something really special. It is available on the 6502 in a restricted form; on the 6502 it is called zero page addressing. Direct page addressing is different , in that any of the 256 pages in the 6516 address space may be used. The particular page is selected by the 8-bit direct page register "Z". The direct page facility should clear up many problems associated with zero page conflicts occuring in the 6502.

The New Instructions

The 6516 has a total of 114 instructions (compared to the 6502's 56). This gives a total of 255 different opcodes. Some of the new instructions are listed on the next page.

The User Flag

Bit 5 of the P register has been undefined to this point in the 6502. The 6516 utilizes this bit as a user defined flag. Included in the instruction set are instructions to set and clear this flag, as well as branch if set, and branch if clear. This user defined flag will prove to be a great help to users who are writing a boolean function. Up till now, the 6502 programmer had to use the carry or overflow flag. The user defined flag will help allieviate problems associated with the use of the aforementioned flags.

The 6516 instruction set was defined to allow maximum capability with the minimum number of instructions possible. For those of you who would really like to have seen an instruction of the form:

```
JMP (LBL,X)
```

you may simulate this by:

```
LDY LBL,X
YPC
```

The instruction sequence still requires only 3 bytes (assuming LBL is a direct page reference) and the timing is 7 cycles which is only two cycles more than a straight jump indirect. This would execute just as fast as a JMP (LBL,X) instruction were it included directly in the instruction set.

For those of you who would like to have seen the auto-increment and auto-decrement instructions of the MC6809, once again they can be simulated by the 6516. For instance, the sequence LAX, INX simulates a post increment and INX, LAX simulates a pre-increment. These instructions require two bytes (the same as the 6809) and execute in 3 to 4 cycles (depending on whether you are in the eight-bit or 16-bit mode). This speed is comparable to the 6809.

The only advantage of the 6809 over the 6516 is the 6809 multiply instruction. However, a software multiply on the 6516 should execute fast enough so that it won't make that big a difference.

The addition of two stacks in the 6809 is no real advantage since you can simulate 2, 3 or even n stacks with one 16-bit stack pointer. Those of you writing machine interpreters (such as the UCSD Pascal Pcode interpreter) will be able to simulate a stack machine quite easily on the 6516.

In my opinion, Synertek has taken everything wrong with the 6502 and fixed it, in addition to adding several features which I had not even previously considered. The 6516 is easily the most powerful 8-bit processor available (with due respects to the Intel 8088 which I would rate "almost there"). This opinion, incidently, is not just my own. EDN rated the 6516 above all the 8-bit processors and even some 16-bit processors, several months ago. If Synertek does indeed make the 6516 processor object code compatable with the 6502, it will definitely make the 6516 something you shouldn't scoff at. Why? Because oncethis happen, 50,000 APPLE II computers will be upgradeable directly to a 16-bit processor and maintain software compatability with existing software. Likewise, the 70,000 or so PETs will be upgradeable and the OSI, and the KIM, and of course, the SYM, etc. etc.

The only fault I find with the 6516 is the assembly language mnemonics chosen by Synertek. They should have followed the example laid down by Motorola and used mneomics which specify the action, leaving the decision of where the data is coming from to the operand field.

I am currently writing a version of LISA (an interactive 6502 assembler for the APPLE II) for the 6516. I will maintain Synertek's syntax, however I will add several extensions to the syntax and instruction set to allow a much more regular syntax. This should prove to be a little more pleasant to the die-hard computer scientist.

The New Instructions

```
LDS    M->S        (LOAD STACK POINTER FROM MEMORY)
LHA    M->AH       (LOAD HIGH ORDER ACC FROM MEMORY)
LHX    M->XH       (LOAD HIGH ORDER X-REG FROM MEMORY)
LHY    M->YH       (LOAD HIGH ORDER Y-REG FROM MEMORY)
LAX    M(X)->A     (LOAD ACC INDIRECT THROUGH X REG)
LAY    M(Y)->A     (LOAD ACC INDIRECT THROUGH Y REG)
SAY    A->M(Y)     (STORE ACC INDIRECT THROUGH Y REG)

ADD    A+M->A      (ADD W/O CARRY)
SUB    A-M->A      (SUBTRACT W/O CARRY)
AXA    A+X->A      (ADD X REG TO ACC)
AYA    A+Y->A      (ADD Y REG TO ACC)
AAX    A+X->X      (ADD ACC TO X REG)
AAY    A+Y->Y      (ADD ACC TO Y REG)
AMX    X+M->X      (ADD MEMORY TO X REG)
AMY    Y+M->Y      (ADD MEMORY TO Y REG)
NEG    NEG(A)->A   (2'S COMPLIMENT ACC)

RLT                (ROTATE LEFT ACC)
RRT                (ROTATE RIGHT ACC)
ASR                (ARITHIMETIC SHIFT RIGHT ACC)
RHL                (ROTATE AH LEFT THROUGH CARRY)
RHR                (ROTATE AH RIGHT THROUGH CARRY)
RXL                (ROTATE X REG LEFT THROUGH CARRY)
RXR                (ROTATE X REG RIGHT THROUGH CARRY)
RYL                (ROTATE Y REG LEFT THROUGH CARRY)
RYR                (ROTATE Y REG RIGHT THROUGH CARRY)

TZA    Z->AL       (TRANSFER Z TO ACC LOW)
YPC    Y->PC       (TRANSFER Y REG TO PC)
PCY    PC->Y       (TRANSFER PC TO Y REG)
XHA    AL(-)AH     (EXCHANGE ACC BYTES)
XHY    YL(-)YH     (EXCHANGE Y REG BYTES)
XHX    XL(-)XH     (EXCHANGE X REG BYTES)
XXY    X(-)Y       (EXCHANGE X WITH Y REGISTAR)
       Qx(-)Qy

SEF    1->F        (SET USER DEFINABLE FLAG)
CLF    0->F        (CLEAR USER DEFINABLE FLAG)
LDQ    M->Q        (LOAD Q REGISTAR FROM MEMORY)
SEV    1->V        (SET OVERFLOW FLAG)

BFS                (BRANCH IF FLAG SET)
BFC                (BRANCH IF FLAG CLEAR)
JNE                (JUMP IF NOT EQUAL TO ZERO 16-BIT RELATIVE)
JEQ                (JUMP IF EQUAL TO ZERO, 16-BIT RELATIVE)

PHD    A->(S)      (16-BIT ACC PUSH)
PLD    (S)->A      (16-BIT ACC PULL)
PHX    X->(S)      (16-BIT X REG PUSH)
PLX    (S)->X      (16-BIT X REG PULL)
PHY    Y->(S)      (16-BIT Y REG PUSH)
PLY    (S)->Y      (16-BIT Y REG PULL)
PHZ    Z->(S),     (PUSH Z REG ONTO STACK,
       Q->(S)       PUSH Q REG ONTO STACK)
PLZ    (S)->Q      (PULL Q FROM STACK,
       (S)->Z       PULL Z FROM STACK )
PHR                (COMBINATION OF PHD, PHX, PHY, AND PHZ)
PLR                (COMBINATION OF PLD, PLX, PLY, AND PLZ)

BR1                (PERFORMS A  JSR ($FFF0) )
BR2                (PERFORMS A  JSR ($FFF2) )
BR3                (PERFORMS A  JSR ($FFF4) )
BR4                (PERFORMS A  JSR ($FFF6) )
BR5                (PERFORMS A  JSR ($FFF8) )
```

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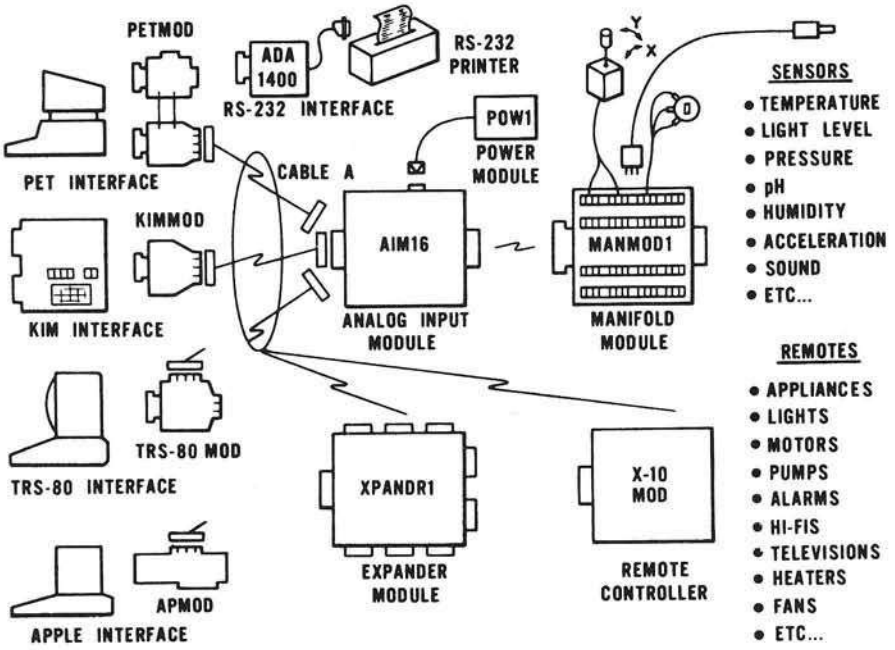

The world we live in is full of variables we want to measure. These include weight, temperature, pressure, humidity, speed and fluid level. These variables are continuous and their values may be represented by a voltage. This voltage is the analog of the physical variable. A device which converts a physical, mechanical or chemical quantity to a voltage is called a sensor.

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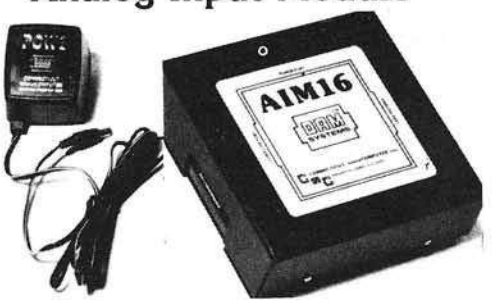
Analog Input Module



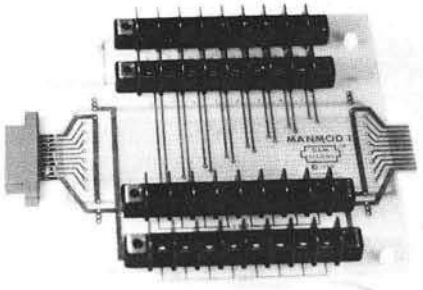
The AIM 16 is a 16 channel analog to digital converter designed to work with most microcomputers. The AIM16 is connected to the host computer through the computer's 8 bit input port and 8 bit output port, or through one of the uMAC SYSTEMS special interfaces.

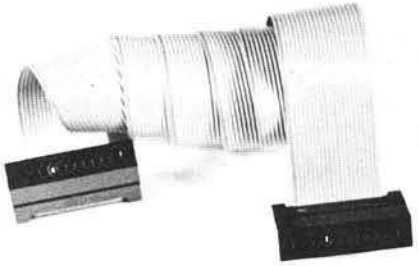
The input voltage range is 0 to 5.12 volts. The input voltage is converted to a count between 0 and 255 (00 and FF hex). Resolution is 20 millivolts per count. Accuracy is 0.5% ± 1 bit. Conversion time is less than 100 microseconds per channel. All 16 channels can be scanned in less than 1.5 milliseconds.

Power requirements are 12 volts DC at 60 ma.

The POW1 is the power module for the AIM16. One POW1 supplies enough power for one AIM16, one MANMOD1, sixteen sensors, one XPANDR1 and one computer interface. The POW1 comes in an American version (POW1a) for 110 VAC and in a European version (POW1e) for 230 VAC.

Connectors



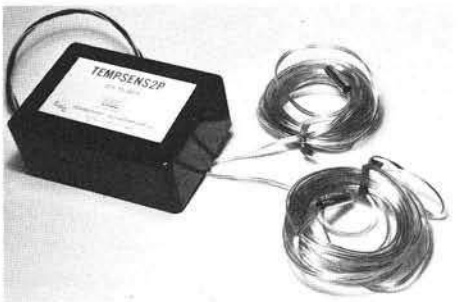


The AIM 16 requires connections to its input port (analog inputs) and its output port (computer interface). The ICON (Input CONnector) is a 20 pin, solder eyelet, edge connector for connecting inputs to each of the AIM16's 16 channels. The OCON (Output CONnector) is a 20 pin, solder eyelet edge connector for connecting the computer's input and output ports to the AIM16.

The MANMOD1 (MANifold MODule) replaces the ICON. It has screw terminals and barrier strips for all 16 inputs for connecting pots, joysticks, voltage sources, etc.

CABLE A24 (24 inch interconnect cable) has an interface connector on one end and an OCON equivalent on the other. This cable provides connections between the uMACSYSTEMS computer interfaces and the AIM 16 or XPANDR1 and between the XPANDR1 and up to eight AIM 16s.

TEMPSENS

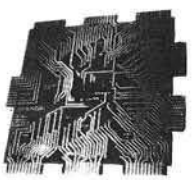


This module provides two temperature probes for use by the AIM16. This module should be used with the MANMOD1 for ease of hookup. The MANMOD1 will support up to 16 probes (eight TEMPSENS modules).

Resolution for each probe is 1°F.

XPANDR1

The XPANDR1 allows up to eight Input/Output modules to be connected to a computer at one time. The XPANDR1 is connected to the computer in place of the AIM16. Up to eight AIM16 modules are then connected to each of the eight ports provided using a CABLE A24 for each module. Power for the XPANDR1 is derived from the AIM16 connected to the first port.



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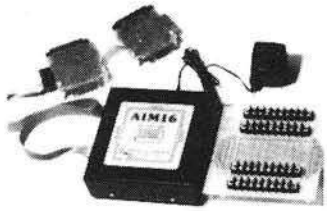

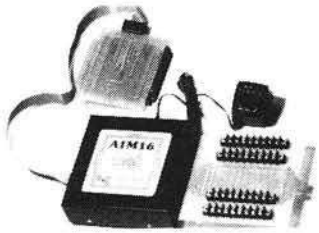

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PET Keysort

One of the most useful operations to perform on a real data base is a keysort. On the PET, due to some problems in the 'garbage collection' procedures, sorting string arrays can become very time consumming. A complete, general purpose keysorting program is presented which has many useful features and is efficient.

Rev. James Strasma
120 West King Street
Decatur,IL 62521

One of the most needed features of any business database program is a good sort routine. On the PET computer, there is also a real need for a way to sort string arrays without changing the strings. This is due to a quirk in the PET's "garbage collection" routine. PET was designed so every time a string is changed, a new string is created. Old versions are erased only after memory is filled. Then it deletes all the unneeded strings at once. As string space increases, collection time increases dramatically. With 24K of strings in memory, it can take several minutes.

Until future ROM's speed this process, it is best to avoid unneeded string manipulations. This makes a different sort program essential. For example, in an attendance program I developed, a heapsort is used. The heapsort itself takes about 20 minutes to sort 500 records. However, garbage collection adds another 2 hours! Clearly this is unacceptable.

One solution would be to define another array of integer string pointers, and sort that array. This would avoid moving strings entirely. As it happens. BASIC already stores its strings that way. Each string array is a table or pointers to another array of the actual strings. The pointers are above the program in memory, at the end of the variables. The strings are usually at the top of memory, though they may be anywhere.

I wrote a 'pointer sort' using the pointer table. It worked, but took too much memory, and had to be part of each program using it. I decided to put it in machine language instead. In the final form, it uses just under 1K of memory, at the top of memory. It resets BASIC's top of memory pointer to protect itself from BASIC, and saves a copy of PET's zerobase to protect basic from the program. The other main features of KEYSORT, are as follows:

1. extreme speed
2. simple operation
3. has defaults for all options
4. works with BASIC arrays
5. Remains until PET is reset
6. accepts any number of fields within a string
7. sorts any specified string array in memory
8. accepts any character as a field marker
9. both strings and fields may individually vary in length
10. extensive error ckecking

The two BASIC demonstration programs will illustrate these features. Listing #1 creates an array of random strings to sort. It does 3000 names in 28 seconds. Once you create an array to sort, merely enter 'sys(31841)' to sort it, either directly or from a program. Later, when you are ready to sort on an array other than the first in memory, try out listing #2. It uses all of KEYSORT's options at once. First, it selects the 'a$' array as the one to sort, ignoring all other arrays. Second, it selects the '?' character as the marker between fields. Using a marker allows one string to hold about 128 separate fields at once. The array may be instantly resorted on any of these fields, as shown in sample run #2, which sorts on field #4, actually the fifth field, since there is a field #0.) You may sort by name one minute, by birthdate the next and by zip code after that.

There is no need for strings to have a fixed length. Nor is there any need for fields within strings to be any special length. This avoids any waste of array space. KEYSORT's default field marker is the [tab] character, chr$(9). This is easily changed, as shown in listing #2. Also there need not be any end of field marker unless you select one. Listing #1 works fine without fields. If time is very important to you. Note that using fields doubles the sort time. In return, it allows you to maintain a single data base, for several programs, and sort only the fields needed by the particular program currently in use. That saves a lot of typing time.

When you study the asssembly source listing of KEYSORT, you will note a subroutine called 'spg'. This is a routine any 6502 owner can use to save up to half of zero base. By placing it at the end of the normal program flow, it only has to be called once, and its ending 'rts' then returns to BASIC.

After you assemble and save a copy of KEYSORT, call it without any arrays in memory. You will immediately see:

```
?array error
ready
```

This is KEYSORT's error message. Here it means no array was found. However, in the process, it reset Himem to protect itself from BASIC. You should do this each time you load KEYSORT, before defining strings. Otherwise they will overwrite the program. Note that if another program has already moved Himem lower than KEYSORT needs, the program leaves it alone.

If you see the '?array error' message at other times, one of several things has gone wrong. Perhaps there is no array to sort, ie. you cleared the variables. Or maybe the array has more than one

dimension—only one is allowed. (Unsorted arrays may have all the dimensions you wish.

Then again, you may have erred in poking in KEYSORT: that becomes the default for future sorts. Note that at the end of listing #2, the seven command locations are reset to zero. Unless the next sort uses the same KEYSORT features or more, you will need to zero those functions not desired in the next sort.

Both the assembly listing and the hex dump of KEYSORT here are for a 32K PET. However, the program is easily relocatable. There is no data in the body of the program, and the program does not change itself. To relocate it, merely change all of the high order bytes of 3 byte instructions, except for the one that jumps to $C357 at $7 of 8. This is a call to the new ROM's error message printer. Table #1 shows all the locations to change for relocation at the top of all PET model's memory. If you have an 'old ROM' PET, (8K '79 or earlier vintage), you will need to make the changes listed in table -2. You will also be limited to 256 element arrays, as the old ROM's couldn't handle more elements than that at once.

Other 6502 users with Microsoft may be able to adapt KEYSORT to their needs. My local 6502 group is converting it to the Apple, which uses a similar memory structure. It may help you to know how PET stores arrays. Each array starts with 7 housekeeping bytes. The first byte of the first array's housekeeping is addressed by 'aras' in BASIC ($2c-2d,) low and high.) The last aray ends just before the address in 'eara', ($2e-2f). The first 2 housekeeping bytes in each array contain its name. If it is a string array, $80 will be added to the second character of the name as a flag. Even if there is no second character,byte 2 will contain $80. Bytes 3 and 4 are the low and high bytes of the offset from the start of the current array to the start of the next one. Byte 5 is the number of dimensions in the array, 1-3. Bytes 6 and 7 are the HIGH and low bytes respectively of the number of elements in the array. (This is backwards from the usual 6502 format.) There will be 1 more element than in the DIM statement, as the 0th element counts too. The 0th element begins immediately after the housekeeping bytes. Each element consists of 3 bytes. The first is the length of the string. The other 2 are the low and high bytes long. Also, when first dimensioned, all the length bytes and address bytes are set to zero.

I wont't try to fully explain the BASIC and assembly listings of KEYSORT; they are fully commented. The only unusual feature in the BASIC programs is the use of PET's built-in 60th of a second jiffy clock, TI. When entering the assembly source, save $3500 for the text file and $0200 for labels. If you have less room available, delete some comments.

If you have questions about KEYSORT, or need help, write me at the above address. Please include a stamped reply envelope. If you want a custom tape copy of KEYSORT, please send along $5 for my time. Also, specify the starting or ending address you wish, and which ROM set you have.

***Table 1:* Locations to change on relocation**

$7C is found at:	$7C62
7EFF	7F3A
$7D is found at:	$7C75
7CF5	7D33
7EAD	7EDC
$7E is found at:	$7DF7
7E48	7E87
$7F is found at:	$7D44
7D8F	7DA4
7DAA	7DC7
7E0C	7E68
7E9A	7EB8
	7ECB

To relocate for:
PET 4K, change 7s to 0s
PET 8K, change 7s to 1s
PET 16K, change 7s to 3s
Code will reside at Himem.

***Table 2:* Changes for using old ROMs**

Source Changes:

Line 430 ARAS .DE $7E
Start of array space [650 & 670]
Line 440 EARA .DE $80
End of array space [1080 & 1120]
Line 450 HIM .DE $86
End of memory [560, 590, 610, & 630]
Line 460 ARER .DE $85
Offset into error table [1320]
Line 470 ERRP .DE $C359
Error msg. and stop [1330]

Object Code Changes

$7C77 = $7E	$7C7B = $7F
$7CC7 = $81	$7CCF = $80
$7C64 = $87	$7C6A = $87
$7C6E = $86	$7C72 = $86
$7CF7 = $85	$7CF9 = $59

```
100 REM> SORT DEMO #1
110 PRINT"SAMPLE RUN FOR LISTING #1":PRINT
120 SZ=10:REM> ARRAY SIZE
130 DIM A$(SZ)
140 REM> MAKE UP STRINGS TO SORT
150 FOR I=0 TO SZ
160 A$=""
170 : FOR J=1 TO 10*RND(0)+1
180 : : A$=A$+CHR$(65+26*RND(0))
190 : NEXT
200 : A$(I)=A$
210 : PRINT I,A$
220 NEXT
230 T1=TI:REM> ZERO THE CLOCK
240 SYS(31845):REM> SORT
250 T2=TI:REM> STOP THE CLOCK
260 PRINT:PRINT"ORDER AFTER SORTING":PRINT
270 REM> PRINT THE SORTED STRINGS
280 FOR I=0 TO SZ
290 : PRINT I,A$(I)
300 NEXT
310 REM> BRAG ABOUT THE TIME REQUIRED
320 PRINT:PRINT"TIME TO SORT="(T2-T1)/60"SECONDS
READY.
```

```
100 REM> KEYSORT DEMO #2
110 PRINT"SAMPLE RUN FOR LISTING #2":PRINT
120 SZ=10:REM> ARRAY SIZE
130 F1=4:REM> FIELD # TO SORT BY
140 D1=ASC(">"):REM> FIELD DELIMITER
150 S$="A$":REM> SORT ARRAY NAME
160 ZC=32731:REM> START OF Z.P. COPY
170 NMFL=ZC+2:REM> FLAGS GIVEN ARRAY
180 DFLG=ZC+3:REM> FLAGS NEW DELIM.
190 DLIM=ZC+4:REM> STORES DELIMITER
200 FDFL=ZC+5:REM> FLAGS KEY FIELD
210 FLDS=ZC+6:REM> STORES KEY FIELD #
220 DIM B$(10,2):REM> GARBAGE
230 DIM C%(10)
240 DIM D(10)
250 DIM A$(SZ):REM> ACTUAL SORT ARRAY
260 REM> MAKE UP STRINGS TO SORT
270 FOR I=0 TO SZ
280 : A$=""
290 : FOR K=1 TO 5:REM> # OF FIELDS
300 : : FOR J=1 TO 10*RND(0)+1
310 : : : A$=A$+CHR$(65+26*RND(0))
320 : : NEXT
330 : : REM> FIELD DELIMITER
340 : : IF K<5 THEN A$=A$+CHR$(D1)
350 : NEXT
360 : A$(I)=A$
370 : PRINT I,A$
380 NEXT
390 REM> TELL SORT FIELD # IS GIVEN
400 POKE FDFL,ASC("#")
410 REM> TELL SORT WHICH FIELD TO USE
420 POKE FLDS,F1
430 REM> GIVE SORT NEW DELIMITER
440 POKE DLIM,D1
450 REM> TELL SORT TO CHANGE DELIMITERS
460 POKE DFLG,ASC("%")
470 REM> CHANGE SORT ARRAY NAME TO BASIC
480 REM> TELL SORT SETTING NAME
490 POKE NMFL,ASC("$")
500 POKE ZC,ASC(S$):REM> CHARACTER #1
510 S2=ASC(MID$(S$,2)):REM> & #2
520 IF S2=ASC("$") THEN S2=128
530 POKE ZC+1,S2
540 T1=TI:REM> ZERO THE CLOCK
550 SYS(31841):REM> SORT
560 T2=TI:REM> STOP THE CLOCK
570 REM> CANCEL SPECIAL OPTIONS
580 FOR I=ZC TO ZC+6
590 : POKE I,0
600 NEXT
610 PRINT:PRINT"SORTED ON FIELD #"F1:PRINT
620 REM> PRINT THE SORTED STRINGS
630 FOR I=0 TO SZ
640 : PRINT I,A$(I)
650 NEXT
660 REM> BRAG ABOUT THE TIME REQUIRED
670 PRINT:PRINT"TIME TO SORT="(T2-T1)/60"SECONDS
READY.
```

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Sample Run for Listing 2

```
 0 BCHRFE>AKKYTGFCH>DG>XT>NTUTHO
 1 YKNJZBKT>NJVSMVI>UOF>NYCCINWGVG>YSCF
 2 IHRQ>WAGQWNEX>X>MP>QGCORK
 3 QJ>HQMWUE>UKQC>GVKPMF>VZ
 4 I>GZTWM>RLH>XSBP>MLWDPWO
 5 E>FL>Q>DRDT>SIVR
 6 F>WO>ZNBZOHCJG>PTQDLIO>ZVGLAH
 7 G>TFZDLKPN>NPCHNZSXMV>GSKC>BWIDSZ
 8 NSDNDTKBO>LPRJWBO>VLCD>FI>OXU
 9 SQPIFSBR>GKVSJCH>WDHCUQ>WQODPC>ZSIGN
10  BLDQENO>AY>Z>L>VAOKJHQR
```

Sorted on Field 4

```
 0 G>TFZDLKPN>NPCHNZSXMV>GSKC>BWIDSZ
 1 I>GZTWM>RLH>XSBP>MLWDPWO
 2 BCHRFE>AKKYTGFCH>DG>XT>NTUTHO
 3 NSDNDTKBO>LPRJWBO>VLCD>FI>OXU
 4 IHRQ>WAGQWNEX>X>MP>QGCORK
 5 E>FL>Q>DRDT>SIVR
 6 BLDQENO>AY>Z>L>VAOKJHQR
 7 QJ>HQMWUE>UKQC>GVKPMF>VZ
 8 YKNJZBKT>NJVSMVI>UOF>NYCCINWGVG>YSCF
 9 SQPIFSBR>GKVSJCH>WDHCUQ>WQODPC>ZSIGN
10  F>WO>ZNBZOHCJG>PTQDLIO>ZVGLAH

 TIME TO SORT= .0833333333 SECONDS
 READY.
```

END OF THE PASS!

```
0010 ;            pet keysort
0020 ;
0030 ; a multi-key sort for pet basic arrays
0040 ;
0050 ;
0060 ;         by rev. james strama
0070 ;            120 w. king st.
0080 ;            decatur, il. 62521
0090 ;
0100 ;         as of feb. 14, 1980
0110 ;
0120 ;
0130 sart       .ba $7c61             ;sys(31841)
0140 ;
0150 ;
0160 ;first 5 var.s poked from basic
0170 arnm       .de $00               ;stores array name
0180 nmfl       .de $02               ;array selected flag
0190 dfls       .de $03               ;delimiter set flag
0200 dlim       .de $04               ;delim. char.
0210 fdfl       .de $05               ;key field set flag
0220 flds       .de $06               ;sort field #
0230 ;
0240 ;
0250 ;most var.s as in basic heapsort
0260 i          .de $07
0270 j          .de $09
0280 k          .de $0b
0290 l          .de $0d
0300 ln         .de $0f               ;1 by-$ lengths
0310 ln1       .de $10               ;"
0320 ln2        .de $11               ;"
0330 n          .de $12               ;elements in array
0340 r1         .de $14               ;3 by-temp. registers
0350 r2         .de $17               ;"
0360 r3         .de $1a               ;"
0370 r4         .de $1d               ;"
0380 s          .de $20               ;"
0390 v1         .de $23               ;pointer start-3
0400 ;
0410 ;
0420 ;rom-dependent var.s
```

```
                    0430 aras       .de $2c             ;start of array space
                    0440 eara      .de $2e             ;end of array space
                    0450 him        .de $34             ;end of memory
                    0460 aer        .de $80             ;offset w/i error table
                    0470 errp       .de $c357           ;error msg. & stop
                    0480 ;
                    0490 ;
                    0500 ;other labels
                    0510 dch        .de $09             ;tab char.
                    0520 locs       .de $24             ;# of locations to flip
                    0530 ;
                    0540 ;
7C61- A9 7C         0550            lda #h,sart         ;lower himem
7C63- C5 35         0560            cmp *him+1          ;unless already lower
7C65- F0 04         0570            beq hok
7C67- B0 0A         0580            bcs sav
7C69- 85 35         0590            sta *him+1
7C6B- A9 61         0600 hok        lda #l,sart         ;hi, then lo
7C6D- C5 34         0610            cmp *him
7C6F- B0 02         0620            bcs sav
7C71- 85 34         0630            sta *him
7C73- 20 A0 7D      0640 sav        jsr spg             ;save z.p.
7C76- A5 2C         0650            lda *aras           ;set current array ptr.
7C78- 85 15         0660            sta *r1+1           ;curr. ar. st.
7C7A- A5 2D         0670            lda *aras+1
7C7C- 85 16         0680            sta *r1+2
7C7E- A5 02         0690            lda *nmfl
7C80- C9 24         0700            cmp #'$             ;flags array name
7C82- F0 06         0710            beq ckna            ;find name to match
7C84- A9 80         0720            lda #$80            ;basic's $ array flag
7C86- 85 00         0730            sta *arnm           ;use any $ array
7C88- 85 01         0740            sta *arnm+1
7C8A- A0 00         0750 ckna       ldy #0
7C8C- B1 15         0760            lda (r1+1),y
7C8E- C5 00         0770            cmp *arnm
7C90- F0 06         0780            beq lok             ;1st. char. ok
7C92- A9 80         0790            lda #$80
7C94- C5 00         0800            cmp *arnm
7C96- D0 08         0810            bne wrnm            ;not right array
7C98- C8            0820 lok        iny
7C99- B1 15         0830            lda (r1+1),y
7C9B- C5 01         0840            cmp *arnm+1         ;now 2nd. char.
7C9D- 30 01         0850            bmi wrnm            ;>=$80 if $ array
7C9F- C8            0860            iny                 ;y>1=right
7CA0- 98            0870 wrnm       tya
7CA1- AA            0880            tax                 ;name flag to x
7CA2- A5 03         0890            lda *dfls           ;flag to change delim.
7CA4- C9 25         0900            cmp #'%             ;unless=, use [tab]
7CA6- F0 04         0910            beq flc2            ;delimiter entered
7CA8- A9 09         0920            lda #dch            ;standard char.
7CAA- 85 04         0930            sta *dlim
7CAC- A5 05         0940 flc2       lda *fdfl           ;see if fields>0
7CAE- C9 23         0950            cmp #'#             ;flag set?
7CB0- F0 04         0960            beq flch            ;yes
7CB2- A9 00         0970            lda #$00            ;no, set 0 fields
7CB4- 85 06         0980            sta *flds
7CB6- A0 02         0990 flch       ldy #2              ;offset to next array
7CB8- B1 15         1000            lda (r1+1),y        ;lo
```

```
7CBA- 18        1010            clc
7CBB- 65 15     1020            adc *r1+1           ;add to current's start
7CBD- 85 18     1030            sta *r2+1           ;to next array ptr.
7CBF- C8        1040            iny
7CC0- B1 15     1050            lda (r1+1),y        ;hi
7CC2- 65 16     1060            adc *r1+2
7CC4- 85 19     1070            sta *r2+2
7CC6- A5 2F     1080            lda *eara+1         ;last array?
7CC8- C5 19     1090            cmp *r2+           ;next ar. st.
7CCA- F0 02     1100            beq ehfd            ;maybe
7CCC- B0 0E     1110            bcs nare            ;no
7CCE- A5 2E     1120 ehfd       lda *eara           ;check lo
7CD0- C5 18     1130            cmp *r2+1
7CD2- F0 02     1140            beq efnd            ;end found
7CD4- B0 06     1150            bcs nare            ;not end
7CD6- E0 02     1160 efnd       cpx #2              ;found array?
7CD8- B0 11     1170            bs fara            ;yes
7CDA- 90 17     1180            bcc oops            ;no
7CDC- E0 02     1190 nare       cpx #2              ;found it?
7CDE- B0 0B     1200            bcs fara            ;yes
7CE0- A5 18     1210            lda *r2+1           ;no, next=current
7CE2- 85 15     1220            sta *r1+1
7CE4- A5 19     1230            lda *r2+2
7CE6- 85 16     1240            sta *r1+2
7CE8- 18        1250            clc
7CE9- 90 9F     1260            bcc ckna            ;jump
7CEB- A0 04     1270fara       ldy #4              ;1 dimension allowed
7CED- B1 15     1280            lda (r1+1),y
7CEF- C9 01     1290            cmp #1
7CF1- F0 08     1300            beq fsiz            ;ok
7CF3- 20 A0 7D  1310 oops       jsr sps             ;restore basic
7CF6- A2 80     1320            ldx #arer
7CF8- 4C 57 C3  1330            jmp errp            ;print error & abort
7CFB- A0 06     1340 fsiz       ldy #6              ;# of elements
7CFD- B1 15     1350            lda (r1+1),y        ;lo
7CFF- 85 12     1360            sta *n
7D01- 88        1370            dey
7D02- B1 15     1380            lda (r1+1),y        ;hi
7D04- 85 13     1390            sta *n+1
7D06- 18        1400            clc                 ;find mid element
7D07- 6A        1410            ror a
7D08- 85 0E     1420            sta *l+1
7D0A- A5 12     1430            lda *n
7D0C- 6A        1440            ror a
7D0D- 18        1450            clc                 ;make % & +1
7D0E- 69 01     1460            adc #1
7D10- 85 0D     1470            sta *l
7D12- A5 0E     1480            lda *l+1
7D14- 69 00     1490            adc #0
7D16- 85 0E     1500            sta *l+1
7D18- A5 15     1510            lda *r1+1           ;current=element#0-3
7D1A- 18        1520            clc
7D1B- 69 04     1530            adc #4
7D1D- 85 23     1540            sta *v1
7D1F- A5 16     1550            lda *r1+2
7D21- 69 00     1560            adc #0
7D23- 85 24     1570            sta *v1+1
                1580
```

```
                    1590 ;k=n
7D25- A5 12         1600          lda *n
7D27- 85 0B         1610          sta *k
7D29- A5 13         1620          lda *n+1
7D2B- 85 0C         1630          sta *k+1
                    1640 ;if l<>1 goto l=l-1
7D2D- A5 0E         1650 main     lda *l+1
7D2F- F0 03         1660          beq ndec
7D31- 4C B2 7D      1670 dec2     jmp decl
7D34- A5 0D         1680 ndec     lda *l
7D36- C9 01         1690          cmp #1
7D38- D0 F7         1700          bne dec2
                    1710 ;r1=k
7D3A- A5 0B         1720          lda *k              ;set k
7D3C- 85 1B         1730          sta *r3+1
7D3E- A5 0C         1740          lda *k+1
7D40- 85 1C         1750          sta *r3+2
7D42- 20 B3 7F      1760          jsr conv            ;ele. # to ptr. addr.
                    1770 ;s=v(k)
7D45- A0 00         1780          ldy #0              ;r(1) to s
7D47- B1 15         1790          lda (r1+1),y
7D49- 85 20         1800          sta *s
7D4B- C8            1810          iny
7D4C- B1 15         1820          lda (r1+1),y
7D4E- 85 21         1830          sta *s+1
7D50- C8            1840          iny
7D51- B1 15         1850          lda (r1+1),y
7D53- 85 22         1860          sta *s+2
                    1870 ;v(k)=v(1)
7D55- A5 23         1880          lda *v1             ;r(2)=v1+3
7D57- 18            1890          clc
7D58- 69 03         1900          adc #$03
7D5A- 85 18         1910          sta *r2+1
7D5C- A5 24         1920          lda *v1+1
7D5E- 69 00         1930          adc #$00
7D60- 85 19         1940          sta *r2+2
7D62- B1 18         1950          lda (r2+1),y        ;(r(1))=(r(2))
7D64- 91 15         1960          sta (r1+1),y
7D66- 88            1970          dey
7D67- B1 18         1980          lda (r2+1),y
7D69- 91 15         1990          sta (r1+1),y
7D6B- 88            2000          dey
7D6C- B1 18         2010          lda (r2+1),y
7D6E- 91 15         2020          sta (r1+1),y
                    2030 ;k=k-1
7D70- 38            2040          sec
7D71- A5 0B         2050          lda *k
7D73- E9 01         2060          sbc #1              ;subtract with borrow
7D75- 85 0B         2070          sta *k
7D77- A5 0C         2080          lda *k+1
7D79- E9 00         2090          sbc #0
7D7B- 85 0C         2100          sta *k+1
                    2110 ;if k<>1 goto jeq1
7D7D- C9 00         2120          cmp #0
7D7F- D0 57         2130          bne jeq1
7D81- A5 0B         2140          lda *k
7D83- D0 53         2150          bne jeq1
                    2160 ;r1=i
```

```
7D85- A5 07     2170            lda *i              ;converted i to r(1)
7D87- 85 1B     2180            sta *r3+1
7D89- A5 08     2190            lda *i+1
7D8B- 85 1C     2200            sta *r3+2
7D8D- 20 B3 7F  2210            jsr conv
                2220 ;v(i)=s
7D90- A5 20     2230            lda *s
7D92- A0 00     2240            ldy #0
7D94- 91 15     2250            sta (r1+1),y        ;s to (r(1))
7D96- C8        2260            iny
7D97- A5 21     2270            lda *s+1
7D99- 91 15     2280            sta (r1+1),y
7D9B- C8        2290            iny
7D9C- A5 22     2300            lda *s+2
7D9E- 91 15     2310            sta (r1+1),y
                2320 ;exchange z.p. s/r
7DA0- A2 24     2330 spg        ldx #locs           ;flip z.p. locations
7DA2- BD DB 7F  2340 slop       lda cpg,x
7DA5- 48        2350            pha
7DA6- B5 00     2360            lda *0,x
7DA8- 9D DB 7F  2370            sta cpg,x
7DAB- 68        2380            pla
7DAC- 95 00     2390            sta *0,x
7DAE- CA        2400            dex
7DAF- 10 F1     2410            bpl slop            ;$7f max
7DB1- 60        2420            rts                 ;end or return
                2430 ;l=l-1
7DB2- 38        2440 decl       sec
7DB3- A5 0D     2450            lda *l
7DB5- E9 01     2460            sbc #1              ;-1
7DB7- 85 0D     2470            sta *l
7DB9- A5 0E     2480            lda *l+1
7DBB- E9 00     2490            sbc #0
7DBD- 85 0E     2500            sta *l+1
                2510 ;r1=l
7DBF- 85 1C     2520            sta *r3+2
7DC1- A5 0D     2530            lda *l              ;conv. l to r(1)
7DC3- 85 1B     2540            sta *r3+1
7DC5- 20 B3 7F  2550            jsr conv
                2560 ;s=v(l)
7DC8- A0 00     2570            ldy #0              ;(r(1)) to s
7DCA- B1 15     2580            lda (r1+1),y
7DCC- 85 20     2590            sta *s
7DCE- C8        2600            iny
7DCF- B1 15     2610            lda (r1+1),y
7DD1- 85 21     2620            sta *s+1
7DD3- C8        2630            iny
7DD4- B1 15     2640            lda (r1+1),y
7DD6- 85 22     2650            sta *s+2
                2660 ;j=l
7DD8- A5 0D     2670 jeql       lda *l
7DDA- 85 09     2680            sta *j
7DDC- A5 0E     2690            lda *l+1
7DDE- 85 0A     2700            sta *j+1
                2710 ;i=j
7DE0- A5 09     2720 ieqj       lda *j
7DE2- 85 07     2730            sta *i
7DE4- A5 0A     2740            lda *j+1
```

```
7DE6- 85 08      2750              sta *i+1
                 2760 ;j=j+j
7DE8- 18         2770              clc
7DE9- 26 09      2780              rol *j                ;double j
7DEB- 26 0A      2790              rol *j+1
                 2800 ;compare j & k
7DED- A5 0A      2810              lda *j+1              ;hi first
7DEF- C5 0C      2820              cmp *k+1
7DF1- F0 05      2830              beq heq
7DF3- 90 0D      2840              bcc j<k
7DF5- 4C 90 7E   2850 toj>         jmp j>k
7DF8- A5 09      2860 heq          lda *j                ;if hi=, then ck. lo
7DFA- C5 0B      2870              cmp *k
7DFC- 90 04      2880              bcc j<k
7DFE- F0 5E      2890              beq jeqk
7E00- B0 F3      2900              bcs toj>
                 2910 ;if j<k then r1=j
7E02- A5 09      2920 j<k          lda *j                ;j to r(1)
7E04- 85 1B      2930              sta *r3+1
7E06- A5 0A      2940              lda *j+1
7E08- 85 1C      2950              sta *r3+2
7E0A- 20 B3 7F   2960             jsr conv
                 2970 ;r2=v(j)
7E0D- A0 00      2980              ldy #0                ;(r(1)) to r(2)
7E0F- B1 15      2990              lda (r1+1),y
7E11- 85 17      3000              sta *r2
7E13- C8         3010              iny
7E14- B1 15      3020              lda (r1+1),y
7E16- 85 18      3030              sta *r2+1
7E18- C8         3040              iny
7E19- B1 15      3050              lda (r1+1),y
7E1B- 85 19      3060              sta *r2+2
                 3070 ;r1=v(j+1)
7E1D- 18         3080              clc
7E1E- A5 15      3090              lda *r1+1
7E20- 69 03      3100              adc #3                ;3 by. betw. ptrs.
7E22- 85 15      3110              sta *r1+1             ;up (r(1)) by 1 ele.
7E24- A5 16      3120              lda *r1+2
7E26- 69 00      3130              adc #0
7E28- 85 16      3140              sta *r1+2
                 3150 ;compare v(j+1) & v(j)
7E2A- A0 02      3160              ldy #2                ;copy to r(3) & r(4)
7E2C- B1 15      3170              lda (r1+1),y          ;v(j+1)
7E2E- 85 1C      3180              sta *r3+2
7E30- 88         3190              dey
7E31- B1 15      3200              lda (r1+1),y
7E33- 85 1B      3210              sta *r3+1
7E35- 88         3220              dey
7E36-B1 15      3230              lda (r1+1),y
7E38- 85 1A      3240              sta *r3
7E3A- A5 19      3250              lda *r2+2             ;v(j)
7E3C- 85 1F      3260              sta *r4+2
7E3E- A5 18      3270              lda *r2+1
7E40- 85 1E      3280              sta *r4+1
7E42- A5 17      3290              lda *r2
7E44- 85 1D      3300              sta *r4
7E46- 20 DF 7E   3310              jsr cmpr              ;compare actual $ data
                 3320 ;if v(j)>=v(j+1) goto jeqk
```

```
7E49- A5 14     3330             lda *r1              ;deciding char.s
7E4B- C5 17     3340             cmp *r2
7E4D- 90 0F     3350             bcc jeqk             ;r(2)>=r(1)
7E4F- F0 0D     3360             beq jeqk
                3370 ;j=j+1
7E51- 18        3380             clc                  ;+1
7E52- A5 09     3390             lda *j
7E54- 69 01     3400             adc #1
7E56- 85 09     3410             sta *j
7E58- A5 0A     3420             lda *j+1
7E5A- 69 00     3430             adc #0
7E5C- 85 0A     3440             sta *j+1
                3450 ;r1=j
7E5E- A5 09     3460 jeqk        lda *j               ;j =ed k
7E60- 85 1B     3470             sta *r3+1            ;conv. j to r(1)
7E62- A5 0A     3480             lda *j+1
7E64- 85 1C     3490             sta *r3+2
7E66- 20 B3 7F  3500             jsr conv
                3510 ;compare v(j) & s
7E69- A0 02     3520             ldy #2               ;(r(1)) =ed v(j)
7E6B- B1 15     3530             lda (r1+1),y
7E6D- 85 1C     3540             sta *r3+2            ;copy for s/r
7E6F- 88        3550             dey
7E70- B1 15     3560             lda (r1+1),y         ;v(j)
7E72- 85 1B     3570             sta *r3+1
7E74- 88        3580             dey
7E75- B1 15     3590             lda (r1+1),y
7E77- 85 1A     3600             sta *r3
7E79- A5 22     3610             lda *s+2             ;s
7E7B- 85 1F     3620             sta *r4+2
7E7D- A5 21     3630             lda *s+1
7E7F- 85 1E     3640             sta *r4+1
7E81- A5 20     3650             lda *s
7E83- 85 1D     3660             sta *r4
7E85- 20 DF 7E  3670             jsr cmpr             ;compare $s
                3680 ;if s<v(j) goto s<vj
7E88- A5 14     3690             lda *r1              ;results here
7E8A- C5 17     3700             cmp *r2              ;r(3)'s in r(2)
7E8C- F0 02     3710             beq j>k              ;if=
7E8E- B0 1E     3720             bcs s<vj             ;if r(1)>r(2)
                3730 ;r1=i
7E90- A5 07     3740 j>k         lda *i               ;v(j)'s<=s's
7E92- 85 1B     3750             sta *r3+1
7E94- A5 08     3760             lda *i+1             ;conv. i to r(1)
7E96- 85 1C     3770             sta *r3+2
7E98- 20 B3 7F  3780             jsr conv
                3790 ;v(i)=s
7E9B- A0 00     3800             ldy #0               ;s to (r(1))
7E9D- A5 20     3810             lda *s
7E9F- 91 15     3820             sta (r1+1),y
7EA1- C8        3830             iny
7EA2- A5 21     3840             lda *s+1
7EA4- 91 15     3850             sta (r1+1),y
7EA6- C8        3860             iny
7EA7- A5 22     3870             lda *s+2
7EA9- 91 15     3880             sta (r1+1),y
7EAB- 4C 2D 7D  3890             jmp main             ;to top of main loop
                3900 ;r2=i
```

```
7EAE- A5 07     3910 s<vj       lda *1              ;s's<v(j)'s
7EB0- 85 1B     3920            sta *r3+1
7EB2- A5 08     3930            lda *1+1            ;conv. i to r(2)
7EB4- 85 1C     3940            sta *r3+2
7EB6- 20 B3 7F  3950            jsr conv
7EB9- A5 15     3960            lda *r1+1           ;move to r(2)
7EBB- 85 18     3970            sta *r2+1
7EBD- A5 16     3980            lda *r1+2
7EBF- 85 19     3990            sta *r2+2
                4000 ;r1=j
7EC1- A5 09     4010            lda *j              ;conv. j to r(1)
7EC3- 85 1B     4020            sta *r3+1
7EC5- A5 0A     4030            lda *j+1
7EC7- 85 1C     4040            sta *r3+2
7EC9- 20 B3 7F  4050            jsr conv
                4060 ;v(i)=v(j)
7ECC- A0 00     4070            ldy #0              ;j's indirect to i's
7ECE- B1 15     4080            lda (r1+1),y
7ED0- 91 18     4090            sta (r2+1),y
7ED2- C8        4100            iny
7ED3- B1 15     4110            lda (r1+1),y
7ED5- 91 18     4120            sta (r2+1),y
7ED7- C8        4130            iny
7ED8- B1 15     4140            lda (r1+1),y
7EDA- 91 18     4150            sta (r2+1),y
7EDC- 4C E0 7D  4160            jmp ieqj            ;back to middle
                4170 ;cmpr $s s/r
7EDF- A0 00     4180 cmpr       ldy #0
7EE1- 84 0F     4190            sty *ln
7EE3- A6 06     4200            ldx *flds
7EE5- D0 0B     4210            bne notz
7EE7- A5 1D     4220            lda *r4             ;sort on field#0
7EE9- 85 10     4230            sta *ln1
7EEB- A5 1A     4240            lda *r3             ;1st. var. in r(3)
7EED- 85 11     4250            sta *ln2            ;2nd. in r(4)
7EEF- 18        4260            clc
7EF0- 90 70     4270            bcc fsh             ;find shorter $
7EF2- A5 04     4280 notz       lda *dlim           ;field delimiter
7EF4- D1 1E     4290 cont       cmp (r4+1),y        ;cmp flag to $ char.
7EF6- F0 08     4300            beq fndd            ;found delim.
7EF8- C8        4310 cnt3       iny
7EF9- C4 1D     4320            cpy *r4             ;end of $?
7EFB- 90 F7     4330            bcc cont            ;no
7EFD- 4C F3 7C  4340            jmp oops            ;on error
7F00- 84 0F     4350 fndd       sty *ln             ;mark current offset
7F02- CA        4360            dex
7F03- F0 02     4370            beq sfld            ;sort field
7F05- B0 F1     4380            bcs cnt3            ;count on
7F07- C8        4390 sfld       iny                 ;@ sort field
7F08- D1 1E     4400            cmp (r4+1),y        ;next char.
7F0A- F0 05     4410            beq fnef            ;field beyond sort
7F0C- C4 1D     4420            cpy *r4             ;end of $?
7F0E- 90 F7     4430            bcc sfld
7F10- C8        4440            iny
7F11- 88        4450 fnef       dey                 ;end or next field
7F12- 98        4460            tya
7F13- 38        4470            sec
7F14- E5 0F     4480            sbc *ln             ;current-start of "
```

```
7F16- 85 10     4490            sta *ln1            ;len sort field
7F18- E6 0F     4500            inc *ln             ;skip delim.
7F1A- A5 0F     4510            lda *ln             ;offset from start
7F1C- 18        4520            clc
7F1D- 65 1E     4530            adc *r4+1           ;start of sort field
7F1F- 85 1E     4540            sta *r4+1
7F21- A5 1F     4550            lda *r4+2
7F23- 69 00     4560            adc #$00
7F25- 85 1F     4570            sta *r4+2           ;r(4)'s done
7F27- A0 00     4580            ldy #0              ;now other $
7F29- 84 0F     4590            sty *ln
7F2B- A6 06     4600            ldx *flds
7F2D- A5 04     4610           lda *dlim           ;only reg.s differ
7F2F- D1 1B     4620 cnt2       cmp (r3+1),y
7F31- F0 08     4630            beq fnd2
7F33- C8        4640 cnt4       iny
7F34- C4 1A     4650            cpy *r3
7F36- 90 F7     4660            bcc cnt2
7F38- 4C F3 7C  4670            jmp oops
7F3B- 84 0F     4680 fnd2       sty *ln
7F3D- CA        4690            dex
7F3E- F0 02     4700            beq sfd2
7F40- B0 F1     4710            bcs cnt4
7F42- C8        4720 sfd2       iny
7F43- D1 1B     4730            cmp (r3+1),y
7F45- F0 05     4740            beq fne2
7F47- C4 1A     4750            cpy *r3
7F49- 90 F7     4760            bcc sfd2
7F4B- C8        4770            iny
7F4C- 88        4780 fne2       dey
7F4D- 98        4790            tya
7F4E- 38        4800            sec
7F4F- E5 0F     4810            sbc *ln
7F51- 85 11     4820            sta *ln2
7F53- E6 0F     4830            inc *ln
7F55- A5 0F     4840            lda *ln
7F57- 18        4850            clc
7F58- 65 1B     4860            adc *r3+1
7F5A- 85 1B     4870            sta *r3+1
7F5C- A5 1C     4880            lda *r3+2
7F5E- 69 00     4890            adc #$00
7F60- 85 1C     4900            sta *r3+2
7F62- A5 10     4910 fsh        lda *ln1            ;found shorter $
7F64- C5 11     4920            cmp *ln2            ;r(4)'s in ln1
7F66- F0 08     4930            beq eq
7F68- B0 0C     4940            bcs two<            ;2nd. shorter?
                4950 ;which longer?
7F6A- 85 0F     4960            sta *ln             ;store least
7F6C- A2 01     4970            ldx #1              ;1st. shorter
7F6E- D0 0C     4980            bne begs            ;jump
7F70- 85 0F     4990 eq         sta *ln
7F72- A2 00     5000            ldx #0              ;same
7F74- F0 06     5010            beq begs            ;jump
7F76- A5 11     5020 two<       lda *ln2
7F78- 85 0F     5030            sta *ln
7F7A- A2 02     5040            ldx #2              ;2nd. shorter
                5050 ;init. $ ctr.
7F7C- C9 00     5060 begs       cmp #0              ;ck. if $ is null
```

```
7F7E- F0 0D     5070            beq null
7F80- A0 00     5080            ldy #0
                5090 ;cmpr next char.
7F82- B1 1B     5100 nex        lda (r3+1),y
7F84- D1 1E     5110            cmp (r4+1),y
7F86- D0 24     5120            bne dif                 ;char.s differ?
7F88- C8        5130            iny                     ;no
                5140 ;beyond last char.?
7F89- C4 0F     5150            cpy *ln
7F8B- 90 F5     5160            bcc nex                 ;<len
                5170 ;if so,which $ is longer?
7F8D- E0 01     5180 null       cpx #1
7F8F- F0 09     5190            beq one<<               ;1st.?
7F91- 10 10     5200            bpl two<<               ;no, 2nd.?
                5210 ;same
7F93- A9 00     5220            lda #0                  ;no
7F95- 85 14     5230            sta *r1                 ;1 rts below selected
7F97- 85 17     5240            sta *r2                 ;from 4 options
7F99- 60        5250            rts
                5260 ;one is <
7F9A- B1 1E     5270 one<<      lda (r4+1),y
7F9C- 85 14     5280            sta *r1
7F9E- A9 00     5290            lda #0
7FA0- 85 17     5300            sta *r2
7FA2- 60        5310            rts
                5320 ;two is <
7FA3- A9 00     5330 two<<      lda #0
7FA5- 85 14     5340            sta *r1
7FA7- B1 1B     5350            lda (r3+1),y
7FA9- 85 17     5360            sta *r2
7FAB- 60        5370            rts
                5380 ;found a difference
7FAC- 85 14     5390 dif        sta *r1
7FAE- B1 1E     5400            lda (r4+1),y
7FB0- 85 17     5410            sta *r2
7FB2- 60        5420            rts
                5430 ;conversion from # to address w/i pointer array s/r
7FB3- A5 1B     5440 conv       lda *r3+1
7FB5- 85 1E     5450            sta *r4+1
7FB7- A5 1C     5460            lda *r3+2
7FB9- 85 1F     5470            sta *r4+2
7FBB- 18        5480            clc
7FBC- 26 1B     5490            rol *r3+1               ;double it
7FBE- 26 1C     5500            rol *r3+2
7FC0- A5 1B     5510            lda *r3+1               ;+t1=t*3
7FC2- 18        5520            clc
7FC3- 65 1E     5530            adc *r4+1
7FC5- 85 1B     5540            sta *r3+1
7FC7- A5 1C     5550            lda *r3+2
7FC9- 65 1F     5560            adc *r4+2
7FCB- 85 1C     5570            sta *r3+2
7FCD- A5 1B     5580            lda *r3+1               ;distance from ar. start
7FCF- 18        5590            clc
7FD0- 65 23     5600            adc *v1
7FD2- 85 15     5610            sta *r1+1               ;result in r(1)
7FD4- A5 1C     5620            lda *r3+2
7FD6- 65 24     5630            adc *v1+1
7FD8- 85 16     5640            sta *r1+2
7FDA- 60        5650            rts
7FDB-           5660 cpg        .ds locs+1              ;save z.p. here
                5670            .en
```

Label File

```
aras =002C      arer =0080      arnm =0000
bess =7F7C      ckna =7C8A      cmpr =7EDF
cnt2 =7F2F      cnt3 =7EF8      cnt4 =7F33
cont =7EF4      conv =7FB3      cpy =7FDB
dch =0009       dec2 =7D31      decl =7DB2
dfls =0003      dif =7FAC       dlim =0004
eara =002E      efnd =7CD6      ehfd =7CCE
eq =7F70        errp =C357      fara =7CEB
fdfl =0005      flc2 =7CAC      flch =7CB6
flds =0006      fnd2 =7F3B      fndd =7F00
fne2 =7F4C      fnef =7F11      fsh =7F62
fsiz =7CFB      heq =7DF8       him =0034
hok =7C6B       i =0007         ieqj =7DE0
j =0009         j<k =7E02       j>k =7E90
jeqk =7E5E      jeql =7DD8      k =000B
l =000D         ln =000F        lnl =0010
ln2 =0011       locs =0024      lok =7C98
main =7D2D      n =0012         nare =7CDC
ndec =7D34      nex =7F82       nmfl =0002
notz =7EF2      null =7F8D      one<< =7F9A
oops =7CF3      r1 =0014        r2 =0017
r3 =001A        r4 =001D        s =0020
s<vj =7EAE      sart =7C61      sav =7C73
sfd2 =7F42      sfld =7F07      slop =7DA2
spq =7DA0       toj> =7DF5      two< =7F76
two<< =7FA3     v1 =0023        wrnm =7CA0

//0000,8000,8000
]
```


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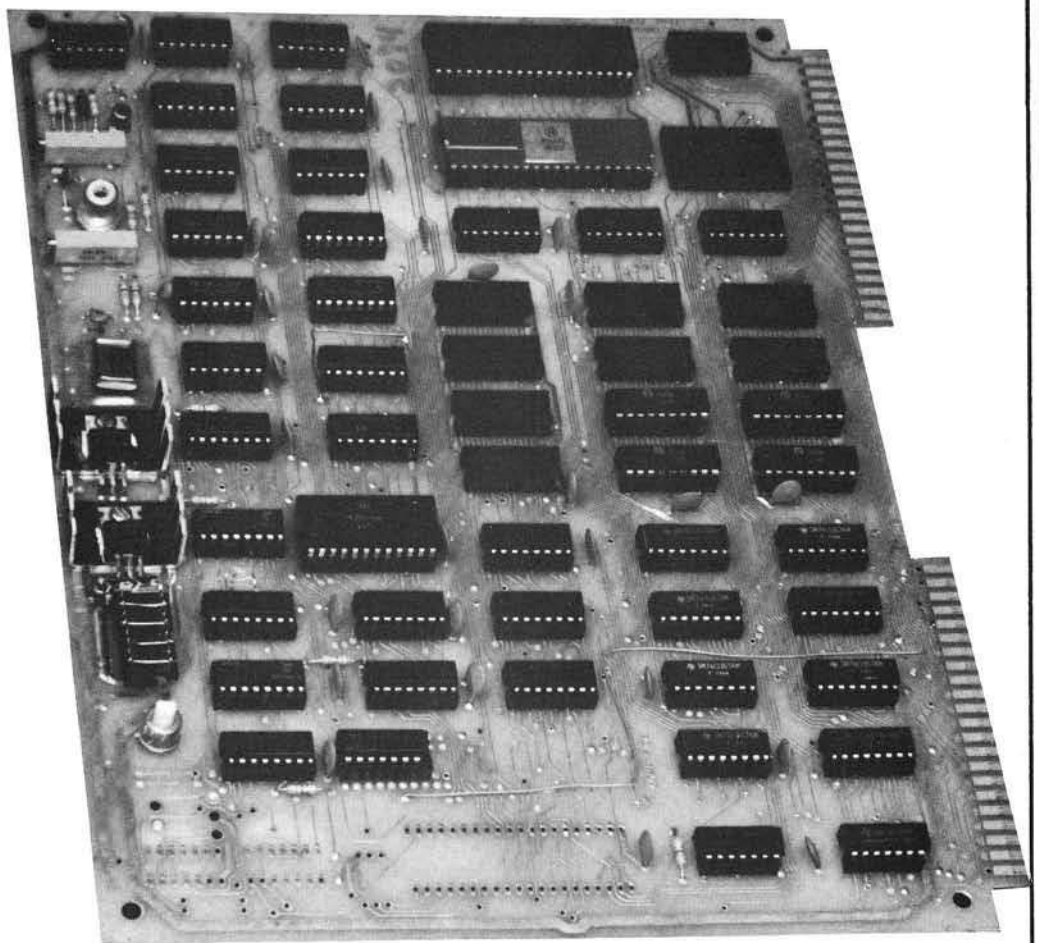

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KIM Scorekeeper

Always on the lookout for new applications for the basic KIM-1, a general purpose, multi-player scorekeeper is presented. The techniques can be readily modified for use on a SYM-1 or AIM 65, and the scorekeeping function can be included as part of larger game programs.

Joel Swank
4655 SW 142nd, 186
Beaverton, OR 97005

Ever have a problem getting someone to keep score for your friendly game of Hearts? Well KIM would like to be a volunteer. KIM will keep up to nine separate scores for you to display and update from the keyboard. Each player can have from 0 to 9999 points, sufficient for most card games or other games needing a scorekeeper. Bridge fans can drop the low order zero from their scores (150 points for a grand slam??). I must credit the idea to a hardware project in October *Popular Electronics* by Joseph Fortuna. He used decade counters and 7-segment LED drivers to two-digit scores. A telephone dial was used to increment to counters. I immediately saw a job that KIM could do with software. Naturally with all the power of KIM available I had to improve and expand the idea.

The KIM SCOREKEEPER uses nine 2-byte memory registers to save the players' scores. Normally one of the players' scores is displayed continuously in the KIM display. The high order digit of the display is the player number, 1 to 9. The next digit is blank and the four low order digits contain that player's score. To display another player's score the PC (Player Change) key is pushed and the display goes blank. Then a number from 1 to 9 is pushed to get that player's score in the display. After a player is selected, the score can be updated. A player's score can be increased by entering the number to be added to the score and pushing the 'E' (Enter) key. Up to four digits can be entered. During entry of a number, the display shows the number being entered in the four low order digits with the two high order digits blank. Digits are shifted through the display as they are entered. If more that four digits are entered, the high order digits are shifted out and lost as in the KIM monitor.

The player's score can be decreased by pushing the 'D' (Decrease) key to set subtract mode. When the subtract mode is in effect, any number entered wil be subtracted from the player's score when the 'E' key is pushed. The high order digit of the display will show a minus sign when the number being entered is to be subtracted. Subtract mode stays in effect until the '+' key is pushed to reset the program to add mode. The '+' and 'D' keys are effective anytime except when performing the player change function. If any key except 0 to 9, '+' or 'D' is entered during the update operation the display returns to the current player. The 'C' (Clear) key may be used to zero the current player's score.

As shown by the programs, SCOREKEEPER has two main display loops. One displays the current player and his score while waiting for a command from the keyboard. The other displays the number being entered while inputting digits from the keyboard. The code is divided into subroutines for the sake of modularity and readability. The KIM subroutine GETKEY is used for communication from the keyboard, and the HEX to 7-segment conversion table in the KIM ROM is used to generate characters. The display is driven directly by the subroutine DISSEG. DISSEG is more flexible than the KIM subroutine SCANDS since it allows individual control of each segment of the KIM display. Thus any pattern can be displayed. DISSEG reads data from memory at SEGBUF and dumps it directly to the KIM display high order digit first. This subroutine could be used in a wide variety of games for KIM.

KIM SCOREKEEPER is an example of KIM's ability to replace and improve a hardware gadget. There is nothing I like more than finding a hardware function that KIM can replace with software. Someday I will calculate the weight of the hardware that my KIM has displaced.

```
0001:                  ****************************************
0002:                  *                                      *
0003:                  *           KIM SCOREKEEPER            *
0004:                  *       VERSION 1 SEPTEMBER 1979       *
0005:                  *                                      *
0006:                  ****************************************
0007:
0008: 0200             SCORER ORG   $0200
0009:
0010:                   ZERO PAGE STORAGE
0011:
0012: 0200             PLAYER *     $0080  PLAYER SCORE TABLE
0013: 0200             MODE   *     $0094  0=ADD ELSE SUBTRACT
0014: 0200             CURPLA *     $0095  INDEX TO CURRENT PLAYER
0015: 0200             CURKEY *     $0096  LAST KEY ENTERED
0016: 0200             TEMP   *     $0097  REGISTER SAVE AREA
0017: 0200             INDEX  *     $0098  REGISTER SAVE AREA
0018: 0200             SEGBUF *     $0099  DISPLAY BUFFER
0019: 0200             NUMBUF *     $009F  NUMBER INPUT BUFFER
0020:
0021: 0200             ZERO   *     $0000
```

```
0022:
0023:                    LABELS
0024:
0025: 0200               GETKEY *     $1F6A  READ THE KEYBOARD
0026: 0200               TABLE  *     $1FE7  HEX TO 7-SEG TABLE
0027: 0200               PADD   *     $1741  DIRECTION REGISTER
0028: 0200               SBD    *     $1742  DIGIT SELECT PORT
0029: 0200               SAD    *     $1740  SEGMENTS OUTPUT PORT
0030:
0031:
0032:                    ****************************************
0033:                    *                                      *
0034:                    *            INITIALIZATION            *
0035:                    *                                      *
0036:                    ****************************************
0037: 0200 A0 02                  LDYIM $02
0038: 0202 A9 00                  LDAIM ZERO   INIT ALL SCORES TO 0
0039: 0204 99 80 00  CLRLUP       STAAY PLAYER
0040: 0207 C8                     INY
0041: 0208 C0 1A                  CPYIM $1A
0042: 020A 90 F8                  BCC   CLRLUP
0043: 020C 85 96                  STA   CURKEY INIT CURRENT KEY
0044: 020E 85 94                  STA   MODE   SET MODE TO ADD
0045: 0210 85 9A                  STA   SEGBUF +01 SECOND DIGIT BLANK
0046: 0212 A9 02                  LDAIM $02    CURRENT PLAYER IS #1
0047: 0214 85 95                  STA   CURPLA
0048:
0049:                    ****************************************
0050:                    *                                      *
0051:                    *              MAINLINE                *
0052:                    *                                      *
0053:                    ****************************************
0054: 0216 20 06 03  GETLUP JSR   DISGET DISPLAY SCORE & GET KEY
0055: 0219 C5 96            CMP   CURKEY DEBOUNCE
0056: 021B F0 F9            BEQ   GETLUP
0057: 021D 85 96            STA   CURKEY
0058:
0059: 021F C9 12            CMPIM $12    PLUS KEY?
0060: 0221 D0 06            BNE   NOPLUS NO
0061: 0223 A9 00            LDAIM ZERO   YES, SET ADD MODE
0062: 0225 85 94            STA   MODE
0063: 0227 F0 ED            BEQ   GETLUP
0064:
0065: 0229 C9 0D      NOPLUS CMPIM $0D    D KEY?
0066: 022B D0 04            BNE   NOMNUS NO
0067: 022D 85 94            STA   MODE   YES SET SUBTRACT MODE
0068: 022F F0 E5            BEQ   GETLUP
0069:
0070: 0231 C9 0C      NOMNUS CMPIM $0C    C KEY?
0071: 0233 D0 06            BNE   NOCLR  NO
0072: 0235 20 4F 02         JSR   CLRCUR YES, CLEAR CURRENT PLAYER
0073: 0238 4C 16 02         JMP   GETLUP
0074:
0075: 023B C9 14      NOCLR  CMPIM $14    PC KEY?
0076: 023D D0 06            BNE   NOPC   NO
0077: 023F 20 59 02         JSR   UPPLAY YES, CHANGE CURRENT PLAYER
0078: 0242 4C 16 02         JMP   GETLUP
0079:
0080: 0245 C9 0A      NOPC   CMPIM $0A    NUMERIC KEY?
0081: 0247 B0 CD            BCS   GETLUP NO, THEN IGNORE IT
0082: 0249 20 6E 02         JSR   UPDATE YES, UPDATE SCORE
0083: 024C 4C 16 02         JMP   GETLUP
0084:
0085:
0086:                    ****************************************
0087:                    *                                      *
0088:                    *  CLRCUR : CLEAR SCORE OF CURRENT     *
0089:                    *               PLAYER                 *
0090:                    *                                      *
0091:                    ****************************************
0092: 024F A6 95      CLRCUR LDX   CURPLA GET PLAYER INDEX
0093: 0251 A9 00             LDAIM ZERO
0094: 0253 95 80             STAZX PLAYER ZERO BOTH BYTES
0095: 0255 E8                INX
0096: 0256 95 80             STAZX PLAYER OF SCORE
0097: 0258 60                RTS
0098:
0099:
0100:                    ****************************************
0101:                    *                                      *
0102:                    *  UPPLAY : GET NUMBER OF NEW CURRENT  *
0103:                    *           PLAYER FROM KEYBOARD       *
0104:                    *                                      *
0105:                    ****************************************
0106: 0259 20 6A 1F  UPPLAY JSR   GETKEY READ KEYBOARD
0107: 025C C5 96            CMP   CURKEY WAIT FOR LAST KEY TO LIFT
0108: 025E F0 F9            BEQ   UPPLAY
0109: 0260 85 96            STA   CURKEY
0110: 0262 C9 01            CMPIM $01    IGNORE LESS THAN 1
0111: 0264 90 F3            BCC   UPPLAY
0112: 0266 C9 0A            CMPIM $0A    AND MORE THAN 9
0113: 0268 B0 EF            BCS   UPPLAY
0114: 026A 0A                ASLA         MULT BY 2 FOR INDEX
0115: 026B 85 95             STA   CURPLA SAVE IT
0116: 026D 60                RTS
0117:
0118:
0119:                    ****************************************
0120:                    *                                      *
0121:                    *  UPDATE : INPUT NUMBER AND UPDATE    *
0122:                    *           SCORE OF CURRENT PLAYER    *
0123:                    *                                      *
0124:                    ****************************************
0125: 026E 85 97      UPDATE STA   TEMP   SAVE FIRST KEY
0126: 0270 A9 00             LDAIM ZERO
0127: 0272 85 9F             STA   NUMBUF CLEAR INPUT BUFFER
0128: 0274 85 A0             STA   NUMBUF +01
0129: 0276 A5 97             LDA   TEMP   RESTORE KEY
0130:
0131: 0278 20 59 03  UPLUP  JSR   SHFKEY SHIFT KEY INTO BUFFER
0132: 027B 20 CB 02  UDLOOP JSR   DISNUM DISPLAY BUFFER
0133: 027E 20 6A 1F          JSR   GETKEY READ KEYBOARD
0134: 0281 C5 96             CMP   CURKEY DON'T READ SAME KEY TWICE
0135: 0283 F0 F6             BEQ   UDLOOP
0136: 0285 85 96             STA   CURKEY
0137: 0287 C9 15             CMPIM $15    IGNORE 'NO KEY'
0138: 0289 F0 F0             BEQ   UDLOOP
0139:
0140: 028B C9 0E             CMPIM $0E    ENTER KEY?
0141: 028D F0 17             BEQ   ADDUM  YES GO CALCULATE
```

```
0142:
0143: 028F C9 12          CMPIM $12    PLUS KEY?
0144: 0291 D0 06          BNE   CKD    NO
0145: 0293 A9 00          LDAIM ZERO   YES, SET ADD MODE
0146: 0295 85 94          STA   MODE
0147: 0297 F0 E2          BEQ   UDLOOP
0148:
0149: 0299 C9 0D     CKD  CMPIM $0D    D KEY?
0150: 029B D0 04          BNE   CKNUM  NO
0151: 029D 85 94          STA   MODE   YES, SET SUBTRACT MODE
0152: 029F F0 DA          BEQ   UDLOOP
0153:
0154: 02A1 C9 0A     CKNUM CMPIM $0A    NUMERIC KEY?
0155: 02A3 90 D3          BCC   UPLUP  YES, PUT IN BUFFER
0156: 02A5 60             RTS          NO, EXIT
0157:
0158: 02A6 A6 95     ADDUM LDX   CURPLA GET CURRENT PLAYER
0159: 02A8 F8             SED          DECIMAL MODE FOR HUMANS
0160: 02A9 B5 80          LDAZX PLAYER GET LO BYTE OF SCORE
0161: 02AB A4 94          LDY   MODE   ADD OR SUBTRACT?
0162: 02AD D0 0E          BNE   SUBTRK SUBTRACT
0163:
0164:                ADD BUFFER TO CURRENT SCORE
0165:
0166: 02AF 18             CLC
0167: 02B0 65 9F          ADC   NUMBUF ADD LO BYTE
0168: 02B2 95 80          STAZX PLAYER & SAVE
0169: 02B4 E8             INX
0170: 02B5 B5 80          LDAZX PLAYER GET HI BYTE
0171: 02B7 65 A0          ADC   NUMBUF +01 ADD HI BYTE OF #
0172: 02B9 95 80          STAZX PLAYER AND SAVE
0173: 02BB D8             CLD          BACK TO BINARY
0174: 02BC 60             RTS
0175:
0176:
0177:                SUBTRACT BUFFER FROM CURRENT SCORE
0178:
0179: 02BD 38        SUBTRK SEC
0180: 02BE E5 9F          SBC   NUMBUF SUBTRACT LO BYTE OF #
0181: 02C0 95 80          STAZX PLAYER AND SAVE
0182: 02C2 E8             INX
0183: 02C3 B5 80          LDAZX PLAYER GET HI BYTE
0184: 02C5 E5 A0          SBC   NUMBUF +01 SUBTRACT HI BYTE OF #
0185: 02C7 95 80          STAZX PLAYER AND SAVE
0186: 02C9 D8             CLD          BACK TO BINARY
0187: 02CA 60             RTS
0188:
0189:                ****************************************
0190:                *                                      *
0191:                *  DISNUM : DISPLAY NUMBER IN BUFFER   *
0192:                *                                      *
0193:                ****************************************
0194: 02CB A9 C0     DISNUM LDAIM $C0    MINUS SIGN
0195: 02CD A6 94            LDX   MODE   SUBTRACT MODE?
0196: 02CF D0 02            BNE   DISMIN YES
0197: 02D1 A9 00            LDAIM ZERO   NO, BLANK FIRST DIGIT
0198: 02D3 85 99     DISMIN STA   SEGBUF
0199: 02D5 A2 02            LDXIM $02    START AT 3RD DIGIT
0200: 02D7 86 98            STX   INDEX
0201: 02D9 A0 01            LDYIM $01    TWICE THRU
0202: 02DB B9 9F 00  NUMLUP LDAAY NUMBUF GET A BYTE
0203: 02DE 20 E7 02          JSR   CVTSEG CONVERT TO SEGS IN BUFFER
0204: 02E1 88                DEY
0205: 02E2 F0 F7             BEQ   NUMLUP QUIT AFTER 2
0206: 02E4 4C 29 03          JMP   DISSEG GO DISPLAY
0207:
0208:
0209:                ****************************************
0210:                *                                      *
0211:                *  CVTSEG : CONVERT 1 BYTE INTO TWO    *
0212:                *           HEX DIGITS IN SEGBUF       *
0213:                *                                      *
0214:                ****************************************
0215: 02E7 85 97     CVTSEG STA   TEMP   SAVE BYTE
0216: 02E9 4A               LSRA
0217: 02EA 4A               LSRA         MOVE HI NYBBLE TO
0218: 02EB 4A               LSRA         LOW NYBBLE
0219: 02EC 4A               LSRA
0220: 02ED AA               TAX          USE AS INDEX AND
0221: 02EE BD E7 1F         LDAAX TABLE  LOAD SEGMENT CODE
0222: 02F1 A6 98            LDX   INDEX  GET BUFFER INDEX
0223: 02F3 95 99            STAZX SEGBUF AND STORE SEGMENT CODE
0224: 02F5 E6 98            INC   INDEX  NEXT BUFFER POSITION
0225: 02F7 A5 97            LDA   TEMP   RESTORE BYTE
0226: 02F9 29 0F            ANDIM $0F    CLEAR HI NYBBLE
0227: 02FB AA               TAX          USE LO NYBBLE AS INDEX
0228: 02FC BD E7 1F         LDAAX TABLE  LOAD SEGMENT CODE
0229: 02FF A6 98            LDX   INDEX  GET BUFFER INDEX
0230: 0301 95 99            STAZX SEGBUF SAVE IN BUFFER
0231: 0303 E6 98            INC   INDEX  NEXT BUFFER POSITION
0232: 0305 60               RTS
0233:
0234:
0235:                ****************************************
0236:                *                                      *
0237:                *  DISGET : DISPLAY CURRENT PLAYER AND *
0238:                *           READ KEYBOARD              *
0239:                *                                      *
0240:                ****************************************
0241: 0306 A5 95     DISGET LDA   CURPLA GET PLAYEQR INDEX
0242: 0308 4A               LSRA         DIVIDE BY 2 TO GET PLAYER #
0243: 0309 AA               TAX          USE AS INDEX
0244: 030A BD E7 1F         LDAAX TABLE  LOAD SEMENT CODE
0245: 030D 85 99            STA   SEGBUF SAVE IN DISPLAY BUFFER
0246: 030F A9 02            LDAIM $02    THIRD DIGIT
0247: 0311 85 98            STA   INDEX  INIT BUFFER INDEX
0248: 0313 A4 95            LDY   CURPLA PLAYER INDEX
0249: 0315 C8               INY          HI BYTE
0250: 0316 B9 80 00         LDAAY PLAYER GET BYTE OF SCORE
0251: 0319 20 E7 02         JSR   CVTSEG CONVERT TO SEGMENT CODES
0252: 031C 88               DEY
0253: 031D B9 80 00         LDAAY PLAYER LO BYTE
0254: 0320 20 E7 02         JSR   CVTSEG CONVERT TO SEGMENTS
0255: 0323 20 29 03         JSR   DISSEG DISPLAY BUFFER
0256: 0326 4C 6A 1F         JMP   GETKEY GO READ KEYBOARD
0257:
0258:
0259:                ****************************************
0260:                *                                      *
0261:                *  DISSEG : LITE KIM DISPLAY WITH      *
0262:                *           CODES FROM SEGBUF          *
0263:                *                                      *
0264:                ****************************************
```

```
0265: 0329 A9 7F      DISSEG LDAIM $7F     SET 6530 TO
0266: 032B 8D 41 17          STA   PADD    OUTPUT
0267: 032E A0 09             LDYIM $09     SELECT DIGIT 1 FIRST
0268: 0330 A9 00             LDAIM ZERO
0269: 0332 85 98             STA   INDEX   CLEAR BUFFER INDEX
0270: 0334 A6 98      DISLUP LDX   INDEX   GET BUFFER INDEX
0271: 0336 B5 99             LDAZX SEGBUF GET A DIGIT FROM BUFFER
0272: 0338 A2 00             LDXIM ZERO
0273: 033A 8E 40 17          STX   SAD     CLEAR DISPLAY
0274: 033D 8C 42 17          STY   SBD     SELECT DIGIT
0275: 0340 8D 40 17          STA   SAD     LITE DIGIT
0276: 0343 A2 7F             LDXIM $7F
0277: 0345 CA         WAIT   DEX           LEAVE IT ON FOR A WHILE
0278: 0346 D0 FD             BNE   WAIT
0279: 0348 E6 98             INC   INDEX   NEXT BUFFER POSION
0280: 034A C8                INY
0281: 034B C8                INY           SELECT NEXT DIGIT
0282: 034C C0 15             CPYIM $15     DUN YET?
0283: 034E 90 E4             BCC   DISLUP  NOPE
0284: 0350 A9 00             LDAIM ZERO
0285: 0352 8D 42 17          STA   SBD     TURN OFF SEGS
0286: 0355 8D 41 17          STA   PADD    TURN OFF 6530
0287: 0358 60                RTS
0288:
0289:
0290:                  ****************************************
0291:                  *                                      *
0292:                  *  SHFKEY : SHIFT KEY INTO NUMBUF      *
0293:                  *                                      *
0294:                  ****************************************
0295: 0359 0A         SHFKEY ASLA
0296: 035A 0A                ASLA          MOVE KEY TO
0297: 035B 0A                ASLA          HI NYBBLE
0298: 035C 0A                ASLA
0299: 035D A2 04             LDXIM $04     SHIFT 4 BITS
0300: 035F 2A         SHFLUP RCLA          FROM ACCUM INTO
0301: 0360 26 9F             ROL   NUMBUF  NUMBER BUFFER
0302: 0362 26 A0             ROL   NUMBUF +01
0303: 0364 CA                DEX
0304: 0365 D0 F8             BNE   SHFLUP
0305: 0367 60                RTS
0306:
0307:
0308:
0309:
```

Symbol Table

ACDUM	02A6	CKD	0299	CKNUM	02A1	CLRCUR	024F
CLRLUP	0204	CURKEY	0096	CURPLA	0095	CVTSEG	02E7
DISGET	0306	DISLUP	0334	DISMIN	02D3	DISNUM	02CB
DISSEG	0329	GETKEY	1F6A	GETLUP	0216	INDEX	0098
MODE	0094	NOCLR	023B	NOMNUS	0231	NOPC	0245
NOPLUS	0229	NUMBUF	009F	NUMLUP	02DB	PADD	1741
PLAYER	0080	SAD	1740	SBD	1742	SCORER	0200
SEGBUF	0099	SHFKEY	0359	SHFLOP	035F	SUBTRK	02BD
TABLE	1FE7	TEMP	0097	UDLOOP	027B	UPDATE	026E
UPLUP	0278	UPPLAY	0259	WAIT	0345	ZERO	0000

April Fools On Us

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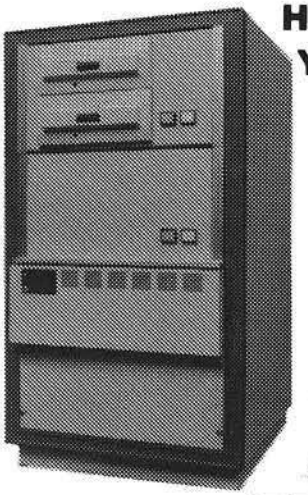

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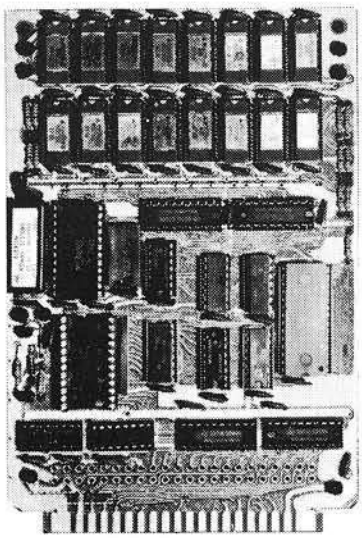

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OSI BASIC in ROM

While the various Microsoft BASICs are easy to use, they are difficult to understand due to an intentional lack of documentation. To help understand your OSI BASIC, a table of the locations of the subroutines to service the main commands is presented. The program which generated the table is provided as a starting point for you to explore your BASIC.

E.D. Morris, Jr.
3200 Washington
Midland, MI 48640

A previous article in Micro 18:9 by S.R. Murphy gave a peek into OSI BASIC in ROM by listing a number of scratch pad locations in page zero. In the present article, I wish to delve further into the inner workings of BASIC by explaining the dispatch table.

At the bottom of the BASIC ROMs, between $A000 and $A083, is a list of addresses known as the dispatch table. These are the starting addresses of all the machine subroutines needed to carry out the BASIC keywords such as END, FOR, NEXT etc. The addresses are in hexidecimal in the normal machine format of low byte first followed by the high order byte. For example, starting at $A000 you find the data:

```
$A000   39
$A001   A6
$A002   55
$A003   A5
```

Thus the first two entries in the dispatch table are $A639 and $A555. These point to subroutines in the BASIC ROMs.

Now we need to know what each subroutine does. Conviently there is another table starting at $A084 containing a list of all the BASIC keywords. The first entries in this table are:

```
$A084   45
$A085   4E
$A086   C4
$A087   46
$A088   4F
$A089   D2
```

Except for the C4 and D2, the data looks like ASCII code. If the high order bit is removed from C4 and D2, then it is ASCII code for ENDFOR. You can demonstrate the list of keywords for yourself by running the program:

```
10  FOR X=41092 TO 41315
20  Y=PEEK (X)
30  PRINT CHR$ (Y);
40  NEXT
```

If you have the OSI graphics character generator, the last letter of each word will be a graphics character instead of a letter. The high bit being set is used to separate the entries in the word list. To convert these to letters and leave a space between key words, add the following line to the above program:

```
25 IF Y > 127 THEN PRINT CHR$(Y-128);:Y=32
```

Now we have two lists, one of addresses and one of functions. These can be combined to give an address for each function.

```
END     $A639
FOR     $A555
```

However things are not quite that simple. Unfortunately the two tables are not strictly in the same order. Also some of the address entries refer to the subroutine location and others to the location, less one. The address table is further complicated in the case of the arithmetic operators by a third entry which is the precedence value.

Following is a BASIC program that sorts out these quirks and outputs a list of BASIC KEYWORDS together with the hex address of the machine code associated with that keyword. Notice that the program does not contain data statements, rather PEEK's directly at your BASIC ROM's. The program steps through the dispatch table printing out each address. The value of Q is added to each address and is either 1 or 0. The correct keyword is found by PEEKing at D until a character is found with the high bit set.

The subroutine at line 500 converts a binary word into ASCII digits for printing.

For those of you who have trouble with this program or for those who have a sore index finger from typing in that 24K game program, I am providing an output listing. However I urge you to run it yourself to prove all this stuff is really "in there." The BASIC program also contains information about the location and structure of the two tables.

Looking at the sample run, the addresses for END and FOR found earlier, are incorrect by one byte. Users of the USR function know that the subroutine address must be placed at $000B and $000C. The dispatch table associates location $000A with the USR function. Location $000A contains 4C or JMP which completes the three byte instruction.

It is interesting to note that the BASIC keyword table is identical to a numerical listing of the BASIC tokens(MICRO 15:20). The keywords TAB, TO, THEN, and STEP are missing from the dispatch table. However these commands are never used alone but always occur with another BASIC keyword (PRINT, FOR, IF and FOR-NEXT). The purists will note the absence of AND, OR, GREATER, LESS

and EQUALS. I must confess, these did not fit neatly into my BASIC program.

If you have ever tried to make sense of "that 8K block of data up there at $A000," it looked like a hopeless task. With the dispatch table at hand, you can break it down and attack one function at a time.

Sample Run
(Program output listing)

A63A	END
A556	FOR
AA40	NEXT
A70C	DATA
A923	INPUT
AD01	DIM
A94F	READ
A7B9	LET
A6B9	GOTO
A691	RUN
A73C	IF
A61A	RESTORE
A69C	GOSUB
A6E6	RETURN
A74F	REM
A638	STOP
A75F	ON
A67B	NULL
B432	WAIT
FFF4	LOAD
FFF7	SAVE
AFDE	DEF
B429	POKE
A82F	PRINT
A661	CONT
A4B5	LIST
A68C	CLEAR
A461	NEW
B7D8	SGN
B862	INT
B7F5	ABS
000A	USR
AFAD	FRE
AFCE	POS
BAAC	SQR
BBC0	RND
B5BD	LOG
BB1B	EXP
BBFC	COS
BC03	SIN
BC4C	TAN
BC99	ATN
B41E	PEEK
B38C	LEN
B08C	STR$
B3BD	VAL
B39B	ASC
B2FC	CHR$
B310	LEFT$
B33C	RIGHT$
B347	MID$
B46F	+
B458	−
B5FE	*
B6CD	/
BAB6	↑

These subroutines are available to use if you are into machine code programing. Mr. Murphy is wrong: OSI users are not disinclined to explore their machines. The problem, until now, has been that too little information was available. So let's dig into OSI's BASIC and publish a complete memory map similar to those already out for the PET and APPLE.

BASIC Program

```
10 Q=1:D=41092
20 FOR C=40960 TO 41060 STEP 2
25 IF C=41016 THEN Q=0:D=41237
30 X=PEEK(C+1):GOSUB 500
40 X=Q+PEEK(C):GOSUB 500
50 PRINT"  ";
60 X=PEEK(D)
70 D=D+1
80 IF X<128 THEN PRINT CHR$(X);:GOTO60
90 X=X-128
100 PRINTCHR$(X)
110 NEXT C
115 D=41224
120 FOR C=41062 TO 41074 STEP 3
130 X=PEEK(C+2):GOSUB 500
140 X=1+PEEK(C+1):GOSUB 500
150 PRINT"  ";
160 X=PEEK(D)
170 D=D+1
180 IF X<128 THEN PRINT CHR$(X);:GOTO 160
190 X=X-128
200 PRINT CHR$(X)
210 NEXT C
220 END

500 REM PRINT SUB
510 H=INT(X/16)
520 L=X-16*H
530 IF H<10 THEN H=H+48:GOTO 550
540 H=H+55
550 IF L<10 THEN L=L+48:GOTO 570
560 L=L+55
570 PRINT CHR$(H);CHR$(L);
580 RETURN
```


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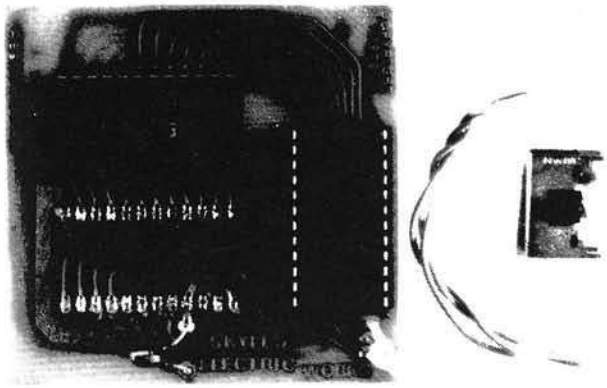

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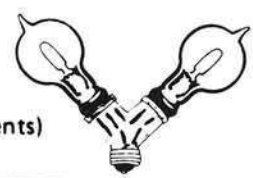

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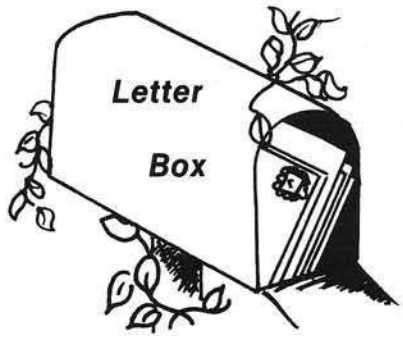

Dear MICRO magazine,

My Dad and I have had an APPLE II for about 9 months. During this time I have learned of the special joys and sorrows that only computer people can appreciate or experience. This poem was born out of long hours at the keyboard. I hope you like it and feel that it is worth publishing.

Ode to My Disk

I always see verses praising the Apple
But who sees the time saved by Disk II, it's ample?

While Apple sits waiting to digest the data
That trusty old "breadbox" spins round without breakdown.

It hasn't been long since I've bought my Disk II
But I know it's worth it and so do you.

I tried Panasonics and Hitachis too
Resetting and loading my Apple I'd do.

Frustrating it was and my hair I did pull
So soon I did tire of ERR MEM FULL.

So now my Hitachi sits dusty and wan
And softly clicks Disk II, no ERR coming on.

Donna Marie Andert
Connelly High School
Anaheim, CA 92801

Dear Editor,

Most articles that are submitted to MICRO are claimed by their authors to execute correctly. The following program has been extensively de-bugged and is guaranteed to run ***neither*** on a PET ***nor*** on an OSI microcomputer.

```
10 FOR X=1 TO 10
20 IF X=5 THEN 40
30 NEXT X
40 REM
100 FOR Y=1 TO 10
110 FOR X=1 TO 10
120 NEXT X
130 NEXT Y
READY.
```

Can you figure out what is wrong here? If not, the answer is given in the next column

E.D. Morris, Jr
Midland, MI 48640

This program was originally part of a 200 line game program with a "small bug." Through a bit of detective work, I narrowed the bug down to these eight lines. In the original game, these lines occurred in widely different sections of the program and appeared not to be related. When the program is executed, the computer will halt indicating "NEXT WITHOUT ERROR IN LINE 130".

This message is most confusing since line 100 clearly contains a "FOR Y". The program will run if lines 100 and 130 are deleted. Something appears to be wrong with the "Y" loop. If "X" is made the outer loop and "Y" is the nested loop, the program will run without error.

This is all a wild goose chase! Nothing is wrong with the "Y" loop. The first real hint of the cause is that replacing the variable "X" in lines 110 and 120 with a different variable, say "Z", solves the problem. The real culprit is line 20 where the program jumps out of a loop before finishing it. It is simple to see here in an eight line program, but not so obvious in a large program. The problem occurs when a variable from an unclosed loop is used again in a nested loop.

The moral of the story is to close loops whenever possible. For example, line 20 could have been:

```
20 IF X=5 THEN Z=X : X=10 : GOTO 30
```

If you can't close the loop, at least avoid using that variable in another loop.

And here is another poem from a reader, sent to us in May, 1979. We hope that he remembered to renew his subscription.

End of Subscription

There once was a town, Albuquerque,
Wherein lived a genuine turkey
Who, on learning his MICRO had died,
Lost what little was left of his pride.

Hadn't realized how close was the end.
Still, he took out his pencil and penn'd
"Mr. Tripp, won't you give me a chance?
My check will disprove miscreance."

Nelson E. Ingersoll
Albuquerque, NM 87110

We at MICRO would like to thank Donna, Earl, Nelson and all of our readers for their contributions. While all of the letters that we get are not as entertaining or as fun as these, they all certainly give us some things to think about. We welcome reader input and we encourage you to write to us with your comments, and suggestions at any time. We hope to run the Letterbox column in every issue, but it all depends on what we get from you.

The MICRO Staff

Apple-Doc

By Roger Wagner

An Aid to the Development and Documentation of Applesoft Programs

This 3 program set is a must to anyone writing or using programs in Applesoft! It not only provides valuable info. on each of your programs, but allows you to change any element throughout the listing almost as easily as you would change a single line!!

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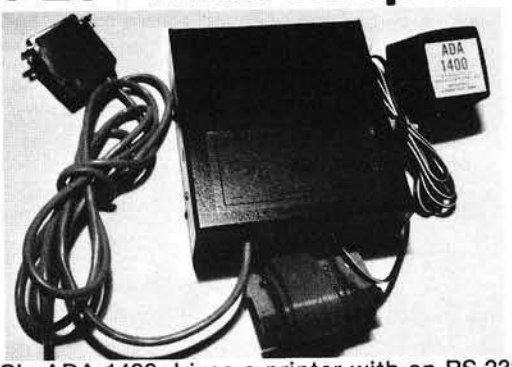

CmC's ADA 1400 drives a printer with an RS-232 interface from the Commodore PET IEEE-488 bus. The ADA 1400 is addressable, works with the Commodore disk and prints upper and lower case ASCII.

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The MICRO Software Catalogue: XIX

Mike Rowe
P.O. Box 6502
Chelmsford, MA 01824

Name: **Dakin 5 Programming Aids II**
System: **Apple II**
Memory: **48K**
Language: **Assembler/Applesoft II**
Hardware: **Apple II, 2 Disk II's, and Printer**

Description: Set of seven programs: 1) *Copier-* copies absolutely any kind of file or program from one diskette to another. 2) *Variable Cross Reference-* creates a cross-reference for all variable neames used in an Applesoft BASIC program, showing all line numbers where a given variable name is used. 3) *Line Cross Reference-* creates a cross-reference for all referenced lines in an Applesoft BASIC program, showing where a given line is referenced by GOTO, GOSUB, THEN, or LIST statements. 4) *Patcher-* allows the user to display any sector of a given file or program, and then to update any data within that sector. A second option enables the user to specify the particular sector he wishes to update. 5) *Screen Printer* - permits contents of the screen to be sent to the printer at any time the keyboard is active. The progrm remains in effect until you press RESET or reboot the system. 6) *Array Editor-* a simple word processor that allows you to create, modify, print and save your own text files. 7) *Calculator II-* a multiplication/division subroutine that handles numeric string data. Written in Assembler code, and using twenty place accuracy, it runs much faster thatn an equivalent BASIC subroutine. It is also compatible with the addition/subtraction subroutine, the Calculator, included in the first Dakin5 Programming Aids package reviewed in the December 1979 issue of The MICRO Software Catalogue XV.

Copies: **Just released**
Price: **$49.95**
Includes: Professionally bound documentation and program diskette.
Author: **Dakin5 Corporation** (developer of The Controller for Apple Computer, Inc.)
Available: Local Apple Dealers

Name: **Page Format TTY IN/OUT**
System: **Apple II**
Memory: **300.3FF (256 Bytes)**
Language: **Machine**
Hardware: **Game Conn to TTY**

Description: Program to output to and input from ASK 33 or 35 Teletype. Gives multiple kine feeds at end of each page and waits for you to tear off roll paper or insert new sheet for neat listings. Uses game connector.

Copies: **Just released**
Price: **$2.00**
Includes: Listing and Instructions
Author: **Ken Ellis**
Available: Ken Ellis
R.D.8 Box 344
York, PA 17403

Name: **HI-RES GRAPHIC CHARTS GENERATOR**
System: **APPLE II, APPLE II PLUS**
Memory: **32K without ROM card, 16k with card**
Language: **APPLESOFT II BASIC**
Hardware **APPLE II, Disk II (allows optional features)**

Description: This program will allow you to generate HI-RES graphic charts, either through keyboard or text file input (if using disk). 'Y' axes will be automatically scaled with values. 'X' axes will be marked for plotting points. Best of all, once graph is automatically created, you can add your own titles, comments, or symbols anywhere on the graph. Both upper and lower case characters are provided. Over 30 special symbols are included. Provisions are also included for multiple graph overlays. Disk II users can automatically have graphs made from existing data already stored.

Copies: **Just releases, 42 copies already sold.**
Price: **$19.95 + $1.25 for postage.**
Includes: Cassette containing program, instructions on unique uses. Please specify when your order, if you have ROM card or not.
Author: **Les Stubbs**
Available: Les Stubbs
23725 Oakheath Pl.
Harbor City, Ca. 90710

Name: **General Ledger Version 2.0**
System: **Apple II**
Memory: **48K**
Language: **Applesoft**
Hardware: **Dual Drives, Any Printer**

Description: General Ledger Version 2.0 — This program is a complete double-entry accounting system. User defined flexibility allowing up to 9 individualized departments in all Financial Reports. 10 levels of subtotals throughout each report gives more detailed Financial Statements. Using 5" drives, storing the entire Chart of Accounts and/or all posting approaches minicomputer times when verifying account numbers or sor-

ting records. High-speed printer routines will process 1,000 postings into 70 accounts in less than 30 minutes. Using 8" drives, high-speed sorting routines requiring no additonal disk work space and fast binary searching techniques allow data files to be limited only by your available disk space. Compatible with any printer and printer interface.

Copies:	**Version 1.0, 200; Version 2.0, Just released.**
Price:	**$180.00**
Author:	**David A. McFarling**
Available:	Small Business Computer Systems 4140 Greenwood Lincoln, NE 68504

Name:	**VOCAB 1.1**
System:	**APPLE II or APPLE II PLUS**
Language:	**Applesoft**
Memory:	**32K**
Hardware:	**APPLE II and DISK II**

Description: A vocabulary builder with over 1200 multiple choice questions allows the user to select either synonyms or antonyms. Intended as study aid for college board type exams (e.g., SAT, ACT, GRE, LSAT, etc.). Editor is included for expanding or modifying data lists. Several test formats with grading are options. Ideal for students with little computer experience.

Price:	**$15.00**
Includes:	User documentation and diskette
Author:	**Steven M. Sliwa**
Available:	Sliwa Enterprises 257 C Clemwood Parkway Hampton, VA 23669

Name:	**SORT**
System:	**PET, APPLE**
Memory:	**32K/16K PET; any Apple**
Language:	**6502 Machine Language**
Hardware	**16K/32K PET, any APPLE**

Description: SORT is a 6502 machine language intelligent sort for commercial applications. Requires almost no user set-up when default values are used. Sorts integer, string and floating point arrays of more than one dimension with up to 20 sub-sorts-on-match (if needed).

Copies:	**Just released**
Price:	**depends on end use**
Author:	**David B. Black**
Available:	MATRIX SOFTWARE INC. 1041 N. Main St. Ann Arbor, MI 48104

Name:	**Investment Comparison**
System:	**Apple II or Apple II Plus**
Memory:	**32K with ROM Applesoft, 48K with RAM Applesoft**
Language:	**ROM Applesoft.**Can be used with RAM Applesoft by relocating above HGR2 display area or not using graphics display feature. 1024 bytes of Machine Code is loaded before Main program.
Hardware:	**Cassette tape. Program supports Printer but driver subroutine not included. Apple II.**

Description: We are often faced with decisions such as 'which of two investments is best?' This program provides a means of comparing them by the use of "Cash Discounting." Cash Discounting is a technique that is used to take into consideration the effects of inflation. Often we are faced with a decision of 'buying now' vs waiting a few years or paying cash vs time payments. The effects of inflation are not easy to quantify without some form of computer analysis. For each of two alternatives, entry include:
1. Inflation Rate for both
2. Initial Investment $
3. Number of years to salvage point and value at that time.
4. Monthly expenses (or income)
5. Adjustments on an annual basis for the monthly expenses. This provides a means whereby you can make expenses track at a different rate than inflation.

Display is in a form of a 'cash Flow' by year, and a graphical presentation is also provided. The graphics have labels.

Copies:	**Just released**
Price:	**$16.95**
Includes:	Cassette, loading instructions, description, and example.
Author:	**Neil A. Robin**
Available:	TECH-DIGIT 21 Canter Lane Sherwood, OR 97140

Name:	**The Life Dynamic Transformation Experience**
System:	**Apple II**
Memory:	**48K**
Language:	**Applesoft and Machine Language**
Hardware:	**Apple II Plus, Disk II**

Description: Unique! This program is designed for all those people who desire to experience self-transformation, life-awareness, making relationships work, and "getting your act together," but do NOT desire to pay est or Lifespring or any of the other "trips" of the Human Potential Movement, $300 or so. Includes game playing as a means to a fun way of increasing awareness.

Copies:	**Many**
Price:	**$15.95**
Includes:	(disk) w/instructions
Author:	**Avant-Garde Creations**
Available:	Avant-Garde Creations P.O.Box 30161 Dept. MC Eugene, OR 97403

Name:	**I CHING**
System:	**Apple II or Apple II Plus**
Memory:	**16K**
Language:	**Integer Basic or Applesoft (please specify)**
Hardware:	**Cassette or disk**

Description: Have your own oracle in your home. Consult the I Ching as others have through the ages. Includes a tutorial and a bibliography, as well as an interpretation of the results.

Copies:	**Just released**
Price:	**$9.95 on cassette; $14.95 on disk**
Author:	**C. Brandon Gresham, Jr.**
Available:	Ad Hoc Enterprises 23 Van Buren Street Dayton, OH 45402

Name:	**MUSIC**
System:	**Any 6502 based system**
Memory:	**1.5K**
Language:	**Assembly**
Hardware:	**Terminal or TVT and a speaker connected to one output port**

Description: Music is an interactive programming language for the creation of patterns of sound; "music". It is a compositional tool, not merely a music table compiler or piano roll type of program. Music's language structure is similar to "ROBOT" (see MICRO no. 10, page 15). Complex hierarchies of user defined functions - strings of musical events - which can be called like subroutines, allow the user to program highly intricate and surprising compositions.

Copies:	**Just released**
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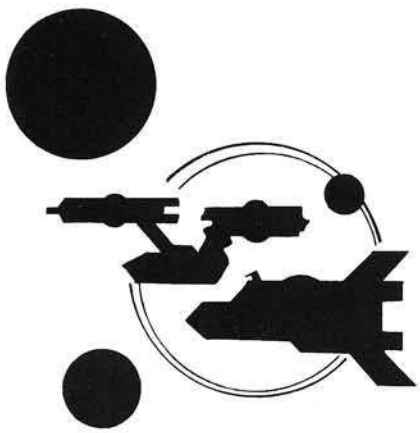

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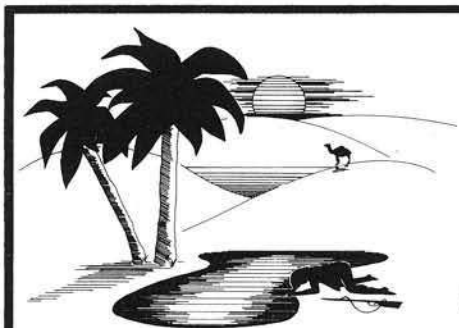

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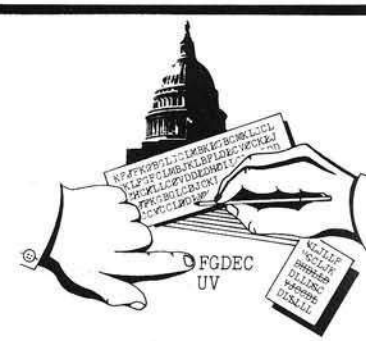

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A memory test program with ways to adapt it to PET, APPLE II, SYM, KIM, TIM, OSI 65D, Western Data Systems, ATARI, AIM, Super Kim, etc...

Thornburg, Katie A. and David D., "Flying with PET PILOT," pgs.40-45.
Kids and microcomputers at Peninsula School.

Tulloch, Michael, "CORVUS 11A Disc Drive," pg. 61.
How about a 9.6 megabyte memory on line? Compatible with the Apple DOS. Plugs into one slot of the Apple II.

Victor, John, "Atari Computers: The Ultimate Teaching Machines?," pgs. 62-64.
Discussion of the advantages of the Atari in educational use.

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Discusses the history of the PET Gazette and its successor.

Butterfield, Jim, "PET in Transition," pgs. 68-70.
Discusses new modifications of the PET and how programs must be modified to accomodate the new systems.

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How to replace the old PET Roms with the new units.

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Discussion of the PET Cassette format.

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TRACE allows you to see Basic executing, displaying each actual line as it is executed.

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A review of the MicroTechnology Unlimited DAC board for Hal Chamberlin's 4-part music program.

Stuart, Chuck, "Using Direct Access Files with the Dual Drive Disk," pgs. 93-96.
A tutorial on the Commodore 0240 Dual Drive Disk.

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North, Steve, "Mountain Hardware SUPERTALKER," pgs. 42-44.
A review of this new accessory for the Apple II.

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Changes in the New PET; more on the structure of Basic variables; Simple variables, PET Basic Pointers, Discussion of cryptograms.

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A move program for the AIM 65.

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A program to show what the 6502 is seeing at the output port of the AIM micro.

Riley, Ron, "AIM BASIC," pgs. 6-8.
All about AIM Basic.

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Negative numbers and subtraction are covered in this continuing tutorial on binary numbers, with examples for the PET and 6502.

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PET Basic program for converting Decimal to Binary.

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Use your PET tapes or at least rewind them occasionally to avoid print through on long undisturbed storage.

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A plotting program for the PET.

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All about Pascal for the Apple.

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A Consumer's guide to Apple II Assemblers: Apple Mini-Assembler, TED/ASM, Micro Products (Moser/Bishop) Assembler, Randy's Weekend Assembler, Aresco

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Demonstration of a couple of ways to print numbers in Integer Basic larger than 32767 on the Apple.

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Arithmetic program for Integer Basic on the Apple.

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All about Modem Operation and the newly established "Apple-Crate," the Call-Apple message system ABBS.

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Routine lets you use commas, etc. in string inputs on the Apple.

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A program to hide program names from appearing in the catalog, but still permitting them to be recovered.

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A routine to change catalog to CC for the 3.2 DOS.

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How to restore a program on a disk after you realize you just wiped out something you didn't mean to, on the Apple.

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Discusses an application of an Apple II in the tire retreading business.

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How to adapt this TRS-80 or PET program on Personal Information Management System to the Apple II.

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A tutorial.

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Three programs for the Apple to convert Applesoft outputs to rounded off dollar and cents values.

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Expand the usefulness of your Apple with this inexpensive addition.

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How to interface a PET to a Centronics 101 Printer.

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Carpenter, Chuck, "Indexing Fundamentals, Part II," pgs. 4-6.
A tutorial on indirect addressing including a routine to read and print a memory range.

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Several hires routines to frame pages of a program.

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Anon., "OSI Programs."
A collection of about 60 programs for OSI computers.

593. The Cider Press 2, No. 5 (September 1979)

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Seventeen more programs.

Anon., "Serial Handshake Modification," pg. 7.
The high speed serial interface card of Apple Computer Company can be made to run faster than 300 baud by simple modification.

Hockenhull, James L., "Better Sounding Apples," pg. 8.
How to improve the sound of the apple by toggling the cassette output jack.

Nareff, Max J., "Crossfooting," pg. 8.
How to use crossfooting in tabulation of numbers.

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Connolly, Rick, "Nicer Writer," pgs. 5-6.
Eliminate wraparound in your Apple.

Reynolds, William, "Disassembling the DOS 3.2," pgs. 7-10.
Use the Apple DOS 3.2 more effectively with this information on its organization.

Scanlon, C. H., "Hooking PET to Ma Bell," pgs. 11-13.
Use your system as a terminal with an inexpensive modem.

Mimlitch, Thomas R., "Spelunker," pgs. 15-24.
An adventure type game for the Apple.

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Chan Hark, "Card Shuffling Program for KIM-1," pgs. 41-42.
Teach the Kim to shuffle the cards.

Hoyt, Bruce, "How Do You Connect Peripherals to Your Superboard II?" pgs. 43-46.
Some concise information on the configuration and use of the I/O Ports of the OSI Superboard II.

Rowe, Mike (staff), "The MICRO Software Catalog: XIII," pgs. 49-51.
Nine programs are reviewed, mostly for Apples.

Morris, E. D., "Hypocycloids," pgs. 52-53.
A fast graphics program for the OSI.

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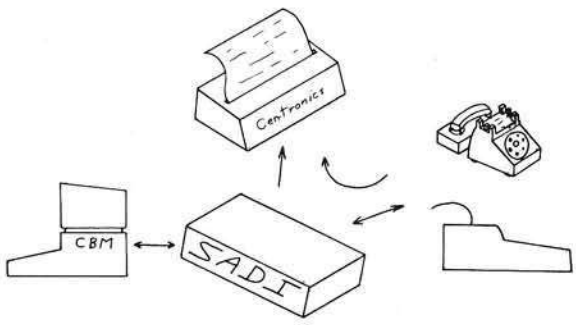

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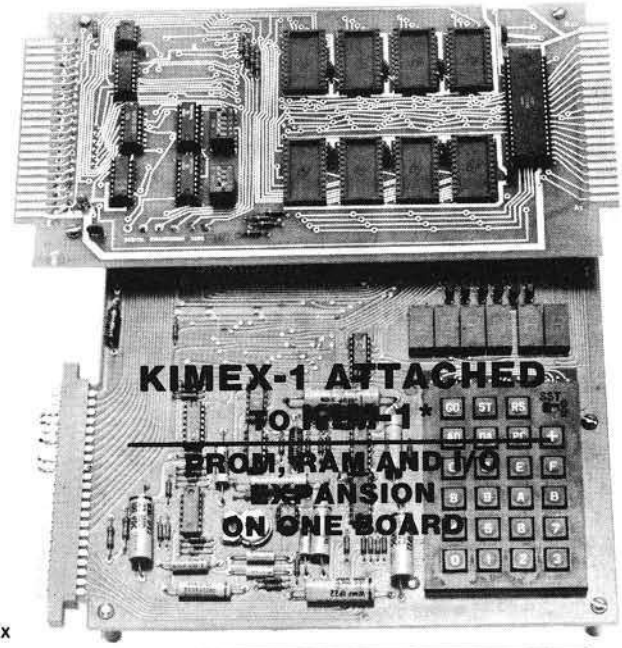

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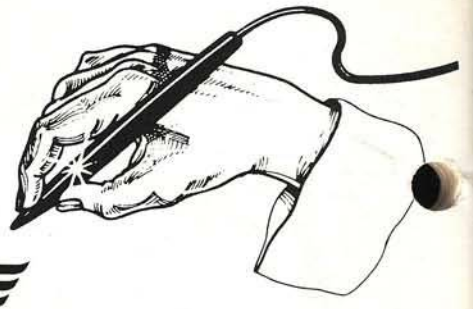


JOURNEY

WELCOME TO JOURNEY.
YOU ARE STANDING BEFORE A SMALL, BRICK WISHING WELL. THE WELL HAS AN OAK WINCH WITH 25 FEET OF ROPE.
MAKE A WISH.
TRY DROPPING A COIN!
DESCRIBE ROPE
THE ROPE APPEARS TO BE IN GOOD CONDITION
CLIMB DOWN ROPE
WHERE DID YOU EXPECT TO CLIMB?
AROUND THE DITCH?

You are about to embark on a very hazardous but profitable JOURNEY. The Apple is your eyes, ears, arms and legs. You can "GET" an object that is laying on the ground and you can travel North, East, South, West, Up and Down. You need to acquire tools as you JOURNEY forth and score precious points to become a GRANDMASTER JOURNEYER. JOURNEY REQUIRES 48K and loads on any Apple.

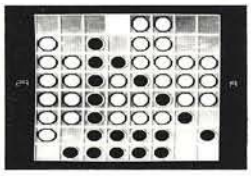
JAB-879 $19.95

BASEBALL FEVER

Catch the fever with this ball game that never gets rained out. You are the pitcher, batter and manager for your team. As manager you control line-ups, pitching staff and base stealers. The optional sound effects enhance the colorful animation. When the game is over you can save the game statistics to tape or disk and you are on your way to a winning season. Requires 32K or 48K with disk. INTEGER BASIC

BFM-879 $12.95

OTHELLO



Play a true competitor of this ancient game of territorial strategy. By flanking a line of the opponents men you "flip" them over to your own color. Be cautious though, for OTHELLO will never say die until the last move. OTHELLO is available for both INTEGER BASIC and APPLESOFT, and loads in 16K.

OHS-279 $14.95

CONEY ISLAND

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*CONTROL C BREAK AND CONTINUE
*COMPATIBLE WITH AUTOSTART ROM
*"SAVE IT" FILE FOR CUSTOMIZING SYSTEM

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With DUMP-RESTORE you will be able to back up your disk files to cassette and restore the disk. This allows you to relocate disk space for maximum efficiency and speed. The programs are saved and restored individually or the entire disk can be saved and restored. DUMP-RESTORE loads with INTEGER BASIC and requires 32K.

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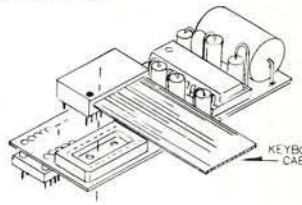
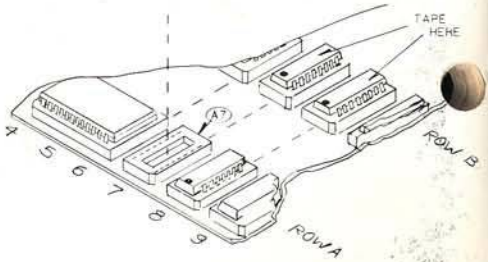
Tired of hitting reset by mistake? If so RESET GUARD will solve the problem. RESET GUARD is a hardware package that plugs directly into your Apple. It protects your programs because it will only Reset if hit twice in one second. Guard your Apple and your sanity with RESET GUARD.

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